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THE FOREST SITUATION IN THE COASTAL PLAIN OF VIRGINIA

by

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A FOREST SURVEY PROGRESS REPORT

U. S. DEPARTMENT OF AGRICULTURE, FOREST SERVICE

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PREFACE

Through the McSweeny - McNary Act of May 1928, Congress authorized the Secretary of Agriculture to conduct a comprehensive survey of the forest resources of the United States. The Forest Survey was organized by the Forest Service to carry out the provisions of the Act, and each of the 12 Regional Experiment Stations is responsible for the work in its territory. In the Middle Atlantic States the Forest Survey is an activity of the Appalachian Forest Experiment Station, Asheville, North Carolina.

The work of the Survey is divided into 5 major phases:

1. Inventory. Determination of the extent, location, and condition of forest lands, and the quantity, species, and quality of the timber on these lands.

2. Growth. Determination of the current rate of timber growth.

3. Drain. Determination of the amount of industrial and domestic wood use, and the total loss from fire, insects, disease, suppression, and other causes.

4. Requirements. Determination of the current and probable future requirements for forest products, by all classes of consumers.

5. Policies and plans. Analysis of the relation of these findings to one another and to other economic factors as a basis for public and private policies and plans of forest land use and management.

This progress report presents preliminary information on the first three of these phases for the Coastal Plain of Virginia (Unit 1), one of the 5 survey units into which the State was divided. A similar release will be prepared for the Piedmont Region (Units 2 and 3) and for the Mountain Region (Units 4 and 5).

Information on the physical forest resources was obtained by a field survey made in the spring of 1941. A total of 7,880 sample plots was established at intervals of one-eighth of a mile on compass lines 10 miles apart, extending across the unit in a northwest direction. The statistical sample obtained from these plot records forms the basis for all area and volume estimates in this report, except where other sources are directly credited. Owing to the method of sampling, small tabular items have the greater probability of error and should be considered as indicating relative magnitude rather than actual values.

Data on consumption of forest products for industrial and domestic purposes were obtained by canvassing all primary manufacturing plants and a number of representative domestic consumers.

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QUICK FACTS

The Coastal Plain of Virginia, Forest Survey Unit 1, contains 6,362,900 acres of land, one-fourth of the total area of the State.

In 1940 the total population was one million, one-half in cities, one-fourth in small towns, and one-fourth on farms.

Urban centers increased in population more than 13 percent between 1920 and 1940, but the rural population increased only one percent in the same period. Rural population decreased in 24 of the 34 counties.

Between 1900 and 1940 the number of farms decreased by 22 percent and the acreage of improved land was reduced by 35 percent.

Abandonment of improved farm land has averaged about 20,000 acres per year since 1900.

One-half of the manufacturing plants in the State and two-fifths of the employees in manufacturing industries are in the Coastal Plain in normal times. War has caused a great influx of industrial workers into the Hampton Roads area.

Forest industries rank second as a source of manufacturing employment.

Sixty-two percent of the land is forested, altogether 3,943,800 acres.

Forty-eight percent of the forest is farm woodland, 13 percent is owned by operating forest industries, 37 percent is held by other private owners, and 2 percent is publicly owned.

One-half of the forest area is stocked with loblolly pine.

Sixty-three percent of the forest land is stocked with saw timber, and 37 percent with young second growth and reproduction. Less than 5 percent of the saw-timber area is old growth.

The total volume by the International $\frac{1}{4}$-inch log rule is 11.7 billion board feet, two-thirds softwood and one-third hardwood. Fifty-two percent of the total volume is loblolly pine.

The total volume of sound wood is 74.3 million cords including bark, 66.0 million in sound trees and 8.3 million in cull trees.

Net annual increment in 1940 amounted to 513 million board feet of softwoods and 236 million feet of hardwoods, a total of 749 million feet.

The total commodity drain by all primary industries and domestic consumers amounted to 606 million board feet or 2.1 million cords.

In the softwoods net increment exceeded drain by 12 million board feet or 198,000 cords.

In the hardwoods net increment exceeded drain by 131 million board feet or 805,000 cords.

FOREST RESOURCES OF THE COASTAL PLAIN OF VIRGINIA

GENERAL DESCRIPTION

Natural Conditions

Forest Survey Unit 1 in Virginia borders the Atlantic seaboard and extends from the Potomac River south to the North Carolina line (fig. 1). It includes all of the Coastal Plain and such areas of the Piedmont as were necessary to adjust the unit to county boundaries. The 34 counties included therein contain 6,362,900 acres, one-fourth of the land in the State.

Topography: This distinct physiographic province is about 125 miles long from north to south and, including Accomac and Northampton counties

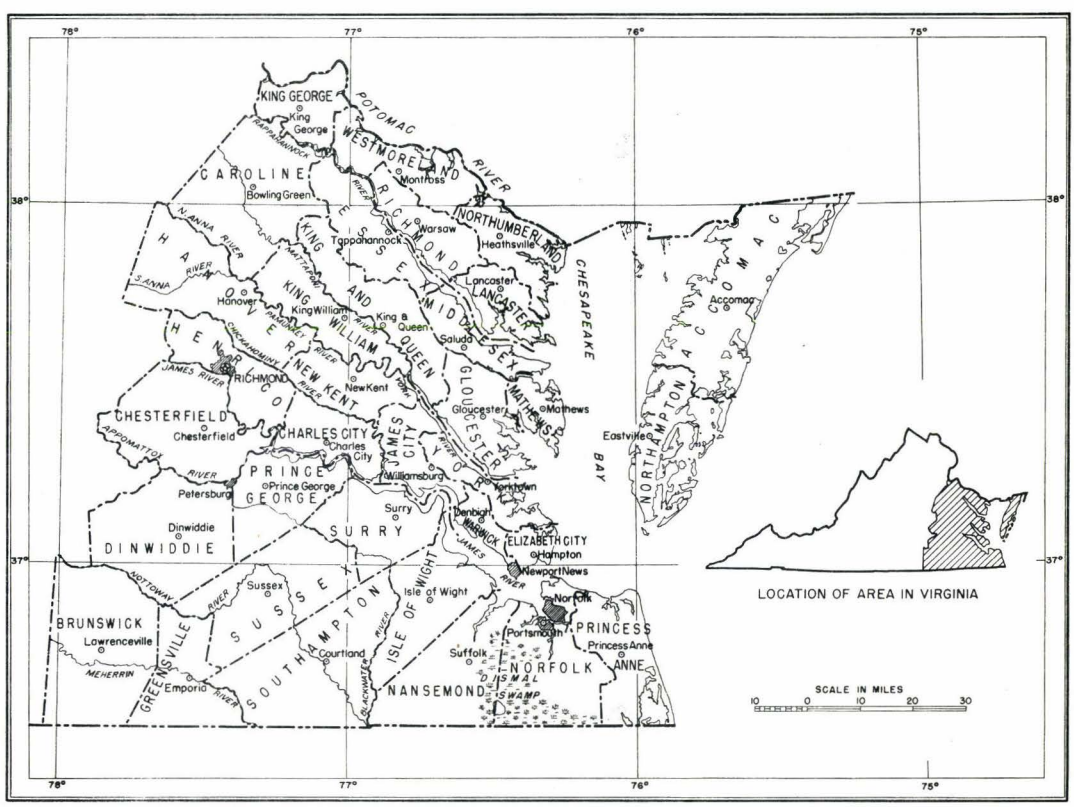

FIGURE 1.- THE COASTAL PLAIN OF VIRGINIA, FOREST SURVEY UNIT NO. 1.

on the Eastern Shore, is about 125 miles wide. It is a gently undulating plain, descending from an elevation of about 300 feet at its western boundary with the Piedmont to sea level at its eastern extremity. The area lying between the coast and the range of high tide in the major water courses is known as the Tidewater. Four major rivers break the northern and central part of the region into three long peninsulas and a fourth,

the Eastern Shore, is separated from the Virginia mainland by the broad reaches of Chesapeake Bay.

Drainage: Five large rivers; the Potomac, the Rappahannock, the York, the James, and the Chowan drain the area. The first four of these flow southeast into Chesapeake Bay and are wide, sluggish, tidal rivers throughout practically their entire length in the Coastal Plain. In conjunction with Chesapeake Bay they form an excellent system of natural harbors, important commercially and even more important from a naval and military standpoint. The Chowan River is in North Carolina, emptying into Albemarle Sound, but the Blackwater, Nottoway, and Meherrin Rivers are important tributaries in Virginia draining a large part of the land south of Petersburg. The Dismal Swamp, lying between Suffolk and Portsmouth, extends south into North Carolina and drainage from this vast depression is chiefly by streams flowing into Albemarle Sound.

Soils: Soils are of three general groups, the poorly drained soils in the swamps and along the tidal streams, the light sandy loams of sedimentary origin on the inter-stream uplands in the Tidewater area, and the clay and sandy loams derived through decay of the underlying rocks in the border zone between the Coastal Plain and the Piedmont. In the first group are the peat soils of the Dismal Swamp, the swamp soils occurring in strips of a few hundred feet to several miles in width along the streams, and the tidal marsh lying between the upland soils and tidewater. Both the peat and swamp soils support a forest cover where not used for agriculture. The soils of the sandy loam group occur in many soil series although the Norfolk and Sassafras sandy loams are particularly abundant and are very productive agricultural soils when fertilized. Less desirable for crops but suitable for timber growing are the poorly-drained types of the Bladen, Lenoir, and Plummer series. Merging onto the Piedmont the clay and sandy loam soils are frequently of the Cecil and Durham series. They usually have a clay subsoil and are subject to sheet erosion. Where erosion and soil exhaustion are severe forests provide an effective method of using and rebuilding the land.

Climate: The climate is mild and conducive to rapid growth of farm and forest crops. Average annual precipitation ranges from about 40 inches along the coast to 48 inches in a narrow belt lying east of Waverly and Emporia. West of this zone the annual precipitation drops gradually to about 42 inches along the western border of the Coastal Plain. July is the wettest month with about 5 inches of precipitation and November is the driest with about 2 inches. Snowfall averages about 9 inches per year at Norfolk, about 16 at Richmond and nearly 17 on the Northern Neck between the Potomac and Rappahannock Rivers.

July and August are the hottest months with an average maximum temperature of about 86° and December, January, and February are the coldest with an average minimum of about 30°. Killing frosts occur about the last f October and can be expected until about the 15th of April. The area surrounding Norfolk has a growing season of about 235 days but the remainder of the region averages about 200 days.

Social and Economic Conditions

Historical: In May 1607 the first permanent English settlement in North America was made in Tidewater Virginia at Jamestown on the James River by a small band of colonists dispatched by the Virginia Company of London. In 1612 John Rolfe introduced the cultivation of tobacco and by 1619 plantations had been established up and down both sides of the James River. By 1700 the population had reached about 70,000 and tobacco was being produced on an increasingly large scale. About this time the importation of negro slaves increased sharply and in 1715 they made up one-fourth of the total population. Just before the Revolutionary War Tidewater Virginia experienced great prosperity as the expansion of slavery and profitable markets resulted in the export of millions of pounds of tobacco. In 1755 there were about 175,000 whites and 120,000 negroes in the region.

Between 1817 and 1830 eastern Virginia experienced a great depression, due in part to the exhaustion of the soils used so intensively for tobacco. Some tobacco growers abandoned their farms and plantations and moved West or South while others substituted cotton for tobacco and tried to rebuild their worn out land. With the soil resource severely depleted for agricultural use after more than a century of exploitation many plantation owners accepted the negro as their major resource. Between 1830 and 1860 Tidewater Virginia supplied a great many of the negroes used in the cotton fields of the Deep South although the records show that in 1860 only 114 individuals in all Virginia owned as many as 100 slaves.

Following the Civil War Virginia was controlled by the Federal Army until 1870. During this time economic progress was slow because government was confused, negroes were a problem, farms and factories were ruined, credit was hard to obtain, and transportation facilities were poor. In the fall of 1869 the voters complied with the terms of the Reconstruction Act and on January 26, 1870, the State ceased to be a Military District. This marked the beginning of Virginia's recovery from the slave system and the War. In the ensuing years Virginia has made steady progress in building a sound social and economic system.

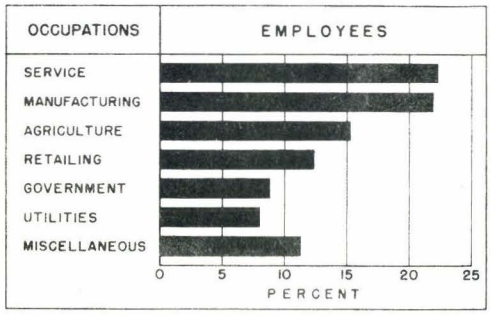

FIGURE 2 - OCCUPATIONS OF EMPLOYED, 1940.

People: In 1900 the total population of the Coastal Plain of Virginia was about 659,000. Total population has increased with each succeeding decade and in 1940 the Bureau of the Census reported the region contained one million people. Approximately one-half of these lived in cities of more than 2,500 inhabitants, one-fourth lived in small towns and communities, and one fourth lived on farms. About 386,000 people were employed in 1940 and they were distributed among the major occupations as indicated in figure 2. Nearly 47 percent of all the people lived in the six cities with more than

10,000 inhabitants -- Richmond, Norfolk, Portsmouth, Newport News, Petersburg, and Suffolk. Richmond is the largest city with a population of 193,000 but almost one-fourth of all the people in the Coastal Plain live in Norfolk, Portsmouth, and Newport News, located at the mouth of the James River. Since the taking of the census on April 1, 1940, the population of this area has increased rapidly because of defense activities; and, if the war does not end in the next four or five years, the population may double by that time.

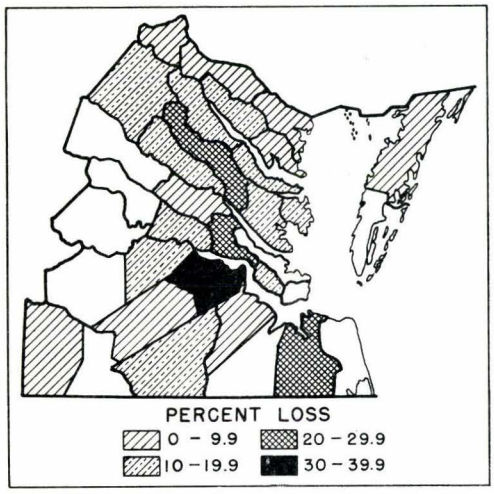

FIGURE 3- COUNTIES LOSING RURAL POPULATION BETWEEN 1920 & 1940.

Urban centers increased in population over 13 percent between 1920 and 1940 but the rural population, including small towns of less than 2,500 inhabitants, increased only one percent during the same period. In 24 counties (fig. 3) the rural population actually decreased in the past 20 years, with losses ranging from 2.7 percent in Sussex County to 33.4 percent in Surry County. Many of the counties north of the James River have a smaller rural population now than in 1900. Soil depletion and opportunities for industrial employment in urban centers have caused many rural people to move to the cities with the result that urban population increased in 11 counties between 1920 and 1940. Industrial development was the basis for most of the increase in Henrico, Chesterfield, Prince George, Warwick, Norfolk, Nansemond, Southampton, and Greenville counties but the urban growth of James City was probably due to the restoration of Williamsburg, that of Princess Anne was probably due to the recreational attractions of Virginia Beach, and that of Elizabeth City was likely due to shipbuilding at Newport News and to military activities at Langley Field and Fort Monroe.

Agriculture: In the four decades between 1900 and 1940 farm land has been abandoned at an average rate of about 32,000 acres per year, thus reducing the farm area by 1.3 million acres or 27 percent. Paralleling this reduction in total farm acreage was the shrinkage in the area of improved farm land - cropland and open pasture, amounting to 774,000 acres (table 1). A large part of the abandoned farm land has restocked to trees and as a result the total forest acreage is increasing while the area of land in agricultural use is gradually decreasing.

Farm land abandonment and a declining rural population have caused a reduction in the total number of farms, from about 51,000 in 1910 to about 38,000 in 1940. With a decrease in both acreage and number of farms the average size of farm has remained relatively constant in the past 40 years. In 1940 the average farm contained 93 acres of which 50 were woodland and 26 were cultivated cropland.

Table 1. - Farms and farm areas in the Coastal Plain, 1900-1940[1/]

Year	Farms	All land in farms		Improved land in farms		Farm woodland	
	Number	Acres	Percent	Acres	Percent	Acres	Percent
1900	48,640	4,827,928	74.6	2,214,989	34.2	-----	-----
1910	51,128	4,587,825	70.9	2,021,722	31.2	-----	-----
1920	51,239	4,199,351	64.9	1,804,343	27.9	2,114,746	50.4
1930	43,078	3,699,588	57.2	1,674,986	25.9	1,808,374	48.9
1940	37,894	3,536,632	55.6	1,441,245	22.7	1,889,479	53.4

1/U. S. Dept. of Commerce, Bureau of the Census.

The climate, topography, and soils of coastal Virginia are suitable for the production of a rather large variety of agricultural crops. Corn, small grains, and hay are grown in practically every county and account for three-fourths of all the harvested cropland. Peanuts are a leading crop south of the James River. Southampton County is the leading producer, but Sussex, Isle of Wight, and Nansemond are close rivals. Winter wheat is grown in the Northern Neck and in the counties bordering the Piedmont, altogether about 50,000 acres in 1939. Every county produced some Irish potatoes in 1939 but two-thirds of the total acreage, 46,000, was in Accomac and Northampton counties on the Eastern Shore. About 9,500 bales of cotton were grown, chiefly in Southampton, Greensville, Brunswick, and Nansemond counties. Sixteen million pounds of tobacco were harvested and most of this was raised in Brunswick and Dinwiddie counties. Sweet potatoes and yams are cultivated in every county and truck crops are produced on a large scale in the Tidewater area. About 15 local veneer and cooperage plants make crates, baskets, and barrels for marketing the vegetables and Irish potatoes.

Livestock is not a major source of income. Three-fifths of the farms are stocked with dairy cattle, but with an average of less than three head per farm. Only 2 percent of the farm operators reported owning beef cattle in 1939, and these few operators averaged only seven head each. Hogs are more numerous, as there were an average of six on two-thirds of the farms. They are particularly abundant in the peanut-growing counties and the hams cured at Smithfield in Isle of Wight County are world famous.

Manufacturing: According to the 1937 Census of Manufactures approximately one-half of the manufacturing plants and two-fifths of the wage earners in the State are in the Coastal Plain. With the exception of the primary wood-using industries, which are widely scattered, most of the manufacturing is concentrated in the larger cities. Richmond is the leading industrial center and is closely followed by the Norfolk, Portsmouth, and Newport News area. Petersburg is the third-ranking manufacturing district and the only other concentrations of manufacturing plants are at Suffolk and Hopewell. Numerous sea-food and vegetable packing plants

are scattered throughout the Northern Neck and to a lesser extent on the Eastern Shore. Several fertilizer and fish oil plants also operate in this general locality.

Industrial activity is widely diversified and each of the important manufacturing centers turns out a variety of products. In Richmond, where the 1937 Census of Manufacturers reported 301 industrial plants employing 18,014 wage earners making products valued at 338 million dollars, the leading products are cigarettes and tobacco, rayon and cellophane, paper and paper products, and iron and steel. Shipbuilding is the major industry in the Norfolk area, although railroad repair shops, fertilizer plants, and forest products industries are prominent. Petersburg manufactures tobacco, textiles, peanuts, and various other products but is chiefly famed for its trunk and baggage factories. Suffolk specializes in the manufacture of peanuts and various kinds of forest products. Hopewell, a small but highly industrialized community, is the site of large plants making paper and paper board, nitrate of soda, chemical cotton, and knit goods.

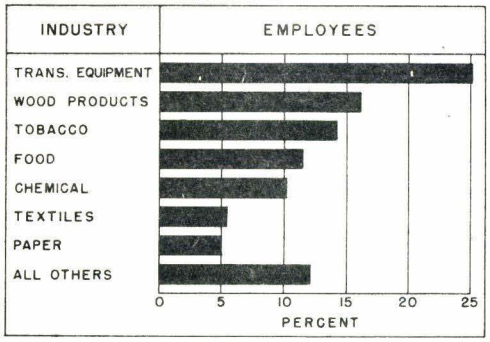

FIGURE 4 - DISTRIBUTION OF EMPLOYEES IN THE MANUFACTURING INDUSTRIES, 1940.

In 1937 the total number of active manufacturing plants in the Coastal Plain of Virginia was 1,135 according to the Bureau of the Census. This total includes the larger primary forest industrial plants but omits many of the small portable sawmills that are difficult to locate and change location frequently. Employment was furnished to 57,000 wage earners, who received about 34 million dollars in wages. They made goods valued at 493 million dollars, adding nearly 153 million dollars of value through manufacture. The distribution of employees among the manufacturing industries in 1940 is indicated in figure 4. In the Coastal Plain shipbuilding is now the leading manufacturing industry, but wood products rank next.

Taxation: Property in Virginia is divided into the following principal classes for purposes of taxation; real estate, tangible personal property, machinery and tools, merchants' capital, intangible property, bank stock, and the property of public service corporations.

The combined county and district levy upon real estate in 1940 ranged from $1.10 per $100 of assessed valuation in Newville District of Sussex County to $3.50 per $100 in Pungo District of Princess Anne County. Assessed value of forest land frequently has little relation to the actual value and both overassessment and underassessment are common. In general assessed values range from about $4.00 per acre for young second growth up to $20.00 per acre for good quality saw timber. At a rate of $1.80 per $100, which is about average for the Coastal Plain, the corresponding tax per acre varies from 7 to 36 cents. Tax delinquency apparently

is not a serious problem at present for only 2.3 percent of all the local taxes levied in the seven tax years ending in 1939 were not paid by 1940. Delinquency was highest in Northampton and Accomac counties.

Table 2. - Distribution of all land by class of owner, 1940

Class of owner	All land	
	Acres	Percent
Farm:		
Owner operators	2,379,200	37.4
Nonresident owners	1,157,400	18.2
Forest industries	504,000	7.9
Other private	2,161,100	34.0
Federal	143,200	2.2
State	18,000	0.3
Total	6,362,900	100.0

Land ownership: Almost 98 percent of the land in the Coastal Plain is privately owned with the largest proportion (table 2) in farm ownership. On the basis of statements obtained at each of the operating forest products plants the primary forest industries own only half a million acres of timberland, about 8 percent of the total land area. Over 2 million acres, one-third of the total, is held by nonfarm and nonforest-industry owners. Part of this land is in towns and cities, rights-of-way, and industrial sites but a large share of it is undoubtedly rural land abandoned over the past half century. Owners of this land are wage earners, merchants, bankers, and professional people who live in small towns and the larger cities. They are a very important class of land-owner but they exert a minimum of supervision over their land which usually lies idle or reverts to forest.

The Federal Departments of War, Navy, Justice, Commerce, and Interior have land in the Coastal Plain. These lands are used for a variety of purposes and many of the tracts consist of a very few acres. A partial list would include cemeteries, army forts, landing fields, ordnance and ammunition depots, proving grounds, navy yards, reformatory camps, lighthouse stations, Coast Guard stations, and military parks. The War Department administers the most land; the largest tract under its jurisdiction is the recently acquired A. P. Hill Military Reservation in Caroline County.

Several commissions, departments, and institutions control the 18,000 acres in State ownership. About 6,700 acres are included in the grounds of state-supported schools and colleges and the State Capitol, 4,700 acres are in the Westmoreland and Seashore State Parks and 4,000 acres are managed for game farms, refuges, and hatcheries. Three Indian reservations contain 2,000 acres and the remaining 600 acres are distributed among experiment stations, farms, roadside parks, and the State Military Reservation.

Forest land in public ownership (table 3) is estimated to be about 100,000 acres. A large part of this acreage is in the A. P. Hill Military Reservation, the Yorktown Mine Depot, Camp Lee, the Reformatory Camp of the Department of Justice, and the two State Parks.

Table 3. - Ownership of forest land, 1940

Class of owner	Forest land	
	Acres	Percent
Public:		
Federal	94,800	2.4
State	6,900	0.2
Total	101,700	2.6
Farm woodlands:		
Owner operators	1,271,600	32.2
Nonresident owners	617,900	15.7
Total	1,889,500	47.9
Forest industries:		
Lumber	366,500	9.3
Pulp and paper	122,000	3.1
Excelsior, stave, veneer	15,500	0.4
Total	504,000	12.8
Other private	1,448,600	36.7
All classes	3,943,800	100.0

Nearly one-half of the forest land is on going farms and two-thirds of this farm woodland is held by farmers who own or partially own their land. One-third of the farm woodland, 16 percent of the total, is owned by nonresident farm owners, and the care of the timber rests chiefly upon tenants and croppers. Forest industries own nearly 13 percent of the timberland and the 504,000 acres is divided among 180 lumber producers, 4 pulp and paper companies, and 13 manufacturers of staves, excelsior, and veneer. Operators of sawmills cutting less than 10,000 board feet per day reported they owned 94,000 acres of forest land. The forest in other private ownership, over one-third of the total, is the timbered portion of the land previously described as belonging to nonresident people who live in rural communities, small towns, and the larger cities.

Distribution of forest land by class of owner is particularly significant when considered in relation to the forestry programs being developed to improve forest management practices. Present emphasis by Federal and State forestry agencies is upon the forest land in farm and industrial ownership and frequently only upon the larger owners in these two classes. Little contact is made with nonresident owners of farm woodlands and other private owners who are not farmers or forest industrialists. In practice this means that most of the effort is expended upon 45 percent of the forest land and the other owners, with over half the land, hear little about forestry.

Table 4. - Total land area classified by major use, 1940

Land use	Area	
	Acres	Percent
Forest:		
Commercial	3,919,200	61.6
Reserved public	24,600	0.4
Total forest	3,943,800	62.0
Nonforest:		
Agriculture:		
Old cropland	1,656,200	26.0
New cropland	28,200	0.4
Pasture	150,500	2.4
Total agr.	1,834,900	28.8
Abandoned cropland	82,100	1.3
Other nonforest	502,100	7.9
Total nonforest	2,419,100	38.0
All uses	6,362,900	100.0

Land use: According to the Forest Survey 62 percent of the land is used for growing timber and 38 percent is nonforested (table 4). Less than

25,000 acres of the forest land is reserved from cutting in Federal or State Parks, all the rest, 3.9 million acres, is classified as commercial timber land.

The 2.4 million acres of nonforest land is chiefly cropland, old, new, and abandoned. Old cropland includes land under cultivation and still workable land cultivated within the last five years. It therefore includes some recently abandoned fields which will gradually restock with trees unless cultivated again within the next few years. Newly cleared land is insignificant in amount. Abandoned cropland is definitely unsuitable for further agricultural use because of erosion, soil exhaustion, or other causes. It could be restored to productivity by planting to forest trees. Most of it is located in the Upper Coastal Plain. Pasture land, which is cleared and fenced, is distributed throughout every county but is most abundant in Brunswick, King George, Hanover, and Dinwiddie counties. The remaining nonforest area consists of land occupied by towns and cities, industrial sites, rights-of-way, marsh, and rural nonfarm homes. In addition it includes the nonwooded portion of reserved public land.

DESCRIPTION OF THE FOREST RESOURCE

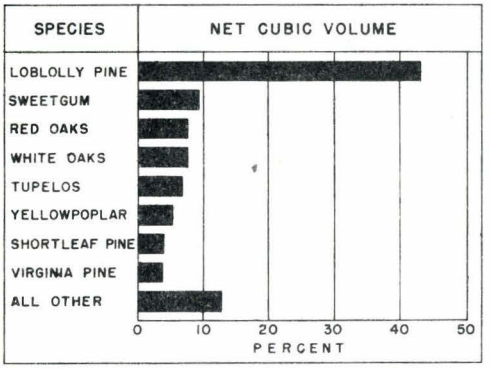

FIGURE 5 - SPECIES COMPOSITION OF THE FOREST, 1940.

Commercial forests occupy 3.9 million acres, 62 percent of all the land. Loblolly pine is the predominant species but sweetgum, red oaks, white oaks, black and water tupelos, yellowpoplar, shortleaf and Virginia pines are comparatively common (fig. 5). Topography, soils, fire, cutting, and land abandonment have all influenced the species composition of the forest but there are six rather distinct species associations or forest types.

Forest Types

Loblolly pine: The loblolly pine type covers forty-nine percent of the forest land and is the major type south of the Rappahannock River drainage basin (fig. 7). Within the Dismal Swamp loblolly pine is of scattered occurrence on the higher less swampy land and it has restocked in pure stands the abandoned fields around the edge of the Swamp. The type grows on practically all sites, occurring in the bottom lands of the larger rivers, the inter-stream uplands of the Tidewater, and the rolling hills of the Upper Coastal Plain. Pure stands of loblolly pine are common, particularly upon the abandoned fields, but other pines and hardwoods are frequent associates. For the type as a whole 73.0 percent of the net cubic volume is loblolly pine, 8.3 percent is red and white oaks, 6.0 percent is sweetgum, 4.9 percent is shortleaf and Virginia pine and the rest is chiefly yellowpoplar, tupelo and red maple.

Upland hardwoods: The upland hardwoods type is only one-half as extensive as the loblolly pine type (fig. 6). It occurs closely associated with the loblolly pine forest on the better-drained uplands and is often the residual stand left after the pine is cut out. It is seldom the major type over any extensive area and for this reason is not shown on the forest type map (fig. 7). Red and white oaks are the leading species accounting for 39.0 percent of the net cubic-foot volume in the type. Other leading species make up the following proportions of the type volume: sweetgum 12.2 percent, beech 8.2 percent, hickories 7.2 percent, and loblolly pine 7.2 percent.

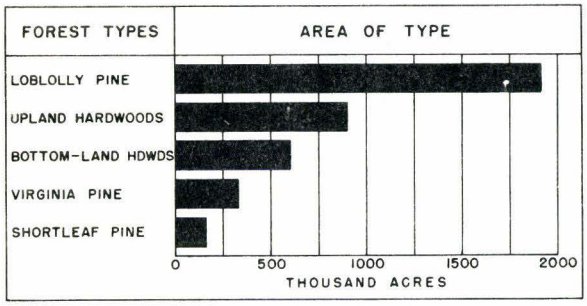

FIGURE 6- DISTRIBUTION OF FOREST AREA BY FOREST TYPE, 1940.

Bottom-land hardwoods: About 15 percent, 608,000 acres, of the forest is composed of the bottom-land hardwoods type. It occurs along most of the larger rivers above the tidal marshes and in the Dismal Swamp. Black and water tupelos, sweetgum, red maple, cypress, and Atlantic white-cedar are the leading components of this type (table 22, Appendix). Red and white oaks are common but relatively less abundant.

There are approximately 90,000 acres in the Dismal Swamp in Virginia and of these, 84,000 are forest land. The bulk of this area, 52,000 acres, has been heavily cut-over and burned and the present vegetative cover consists of a dense jungle of briars penetrated occasionally by young red maples or black tupelos. Because these young trees have at least partially stocked the land it was not classified as clear-cut by the Forest Survey even though such areas are locally referred to as "lights" or "open ground." The timbered portion of the Swamp, about 32,000 acres, is stocked with sweetgum, black tupelo, cypress, and red maple growing in mixture and with Atlantic white-cedar growing in relatively pure stands. Most of the estimated 8,000 acres of white-cedar lies southwest of Lake Drummond. In January 1940 approximately one-third of the timbered land supported old growth, chiefly black tupelo, cypress, and red maple.

Virginia pine: The Virginia pine type extends from the Piedmont across the Coastal Plain almost to Chesapeake Bay in a belt about 25 miles wide paralleling the Potomac River. It occupies about 331,000 acres of land, 8 percent of the forest area. Forty-two percent of the net cubic volume of the type is Virginia pine, 20 percent is loblolly pine, and 10 percent is red oak. White oak, yellowpoplar, and sweetgum are also common associates of Virginia pine in the pine-mixed hardwood phase of this type.

Shortleaf pine: The shortleaf pine type is of limited extent in the Coastal Plain, occupying only 164,000 acres, 4 percent of the forest

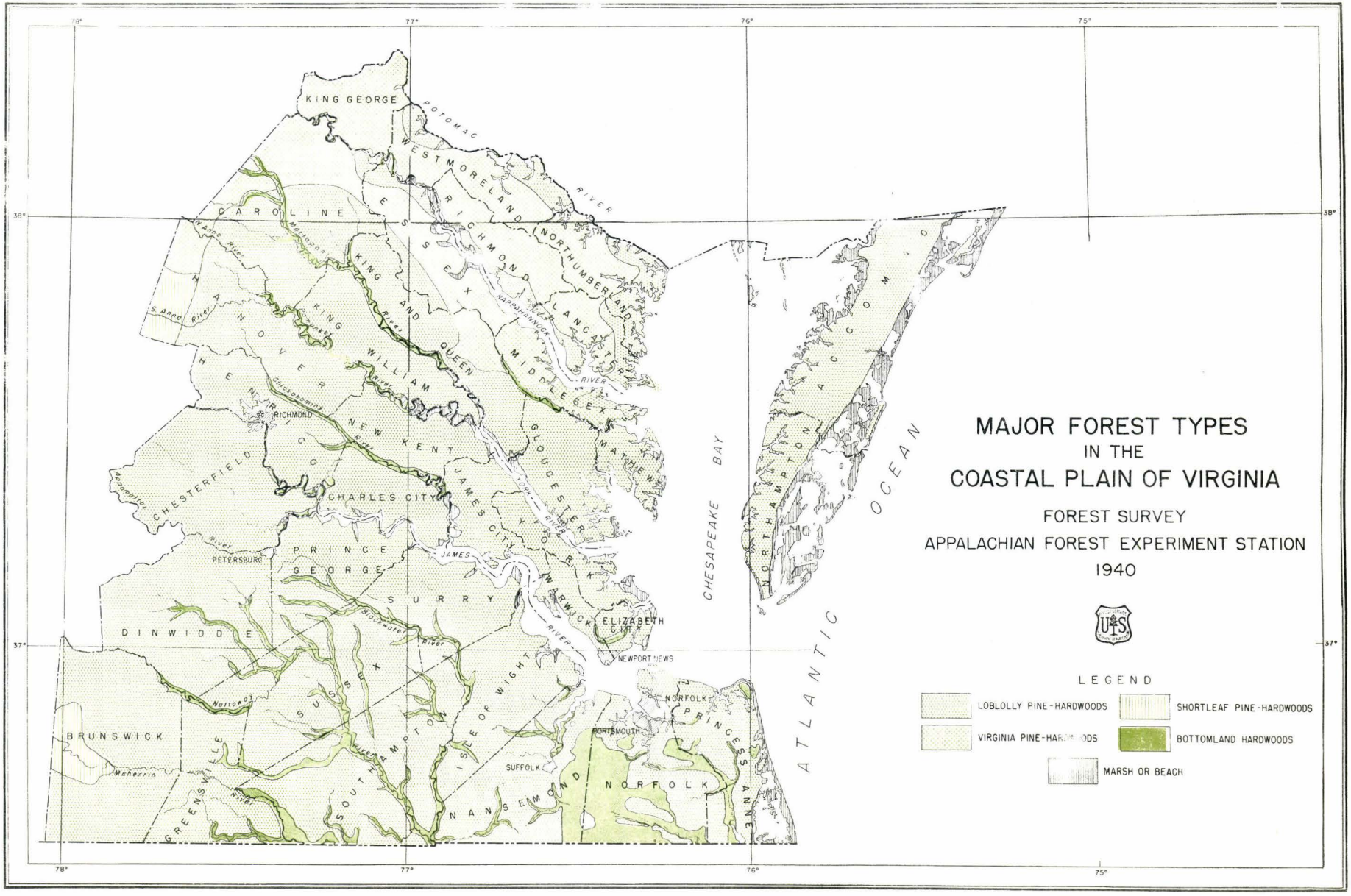
MAJOR FOREST TYPES
IN THE
COASTAL PLAIN OF VIRGINIA
FOREST SURVEY
APPALACHIAN FOREST EXPERIMENT STATION
1940
LEGEND
LOBLOLLY PINE-HARDWOODS
SHORTLEAF PINE-HARDWOODS
VIRGINIA PINE-HARDWOODS
BOTTOMLAND HARDWOODS
MARSH OR BEACH
KING GEORGE
WESTMORELAND
RICHMOND
NORTHUMBERLAND
LANCASTER
CAROLINE
ESSEX
KING AND QUEEN
KING WILLIAM
MIDDLESEX
HANOVER
RICHMOND
CHESTERFIELD
NEW KENT
JAMES CITY
CHARLES CITY
GLOUCESTER
MATHEWS
PRINCE GEORGE
SURRY
DINWIDDIE
PETERSBURG
WARWICK
ELIZABETH CITY
NEWPORT NEWS
NORFOLK
PRINCESS ANNE
PORTSMOUTH
SUFFOLK
NANSEMOND
SUSSEX
BRUNSWICK
ISLE OF WIGHT
SOUTHAMPTON
GREENSVILLE
NORTHAMPTON
ACCOMAC
CHESAPEAKE BAY
ATLANTIC OCEAN
POTOMAC RIVER
RAPPAHANNOCK RIVER
YORK RIVER
JAMES RIVER
APPOMATTOX RIVER
NOTTOWAY RIVER
MEHERRIN RIVER
BLACKWATER RIVER
NOMINI RIVER
PIANKATANK RIVER
MATTAPONI RIVER
PAMUNKEY RIVER
NORTH ANNA RIVER
SOUTH ANNA RIVER
CHICKAHOMINY RIVER
78°
77°
76°
75°
38°
37°

FIGURE 7

land. It is the major type in the southwest portion of Hanover County and occupies a limited area west of Lawrenceville in Brunswick County, but elsewhere along the western boundary of the Coastal Plain is subordinate to the loblolly pine type. About 53 percent of the net cubic volume of the type is shortleaf pine and 17 percent is loblolly pine. Only one percent is Virginia pine. Hardwoods make up the remaining type volume with the red and white oaks, sweetgum and yellowpoplar the leading species.

Forest Conditions

The trees of coastal Virginia vary in age, size, and quality and the stands composed of these trees differ in volume-per-acre and in the degree to which they have been cut. These differences are the basis for classifying the forest into forest conditions.

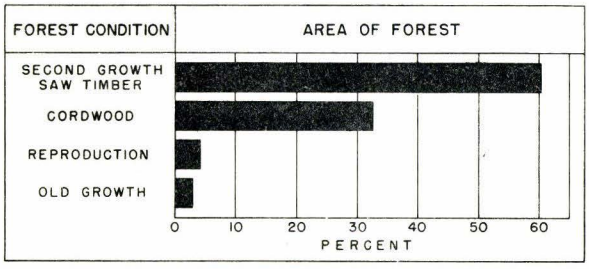

FIGURE 8 - DISTRIBUTION OF FOREST AREA BY FOREST CONDITION, 1940.

Second-growth saw timber: This condition class occupies 2.3 million acres of land, 60 percent of the forest area (fig. 8). It is found on 50 to 60 percent of all type areas except loblolly pine which has 65 percent of its area stocked with merchantable second growth. Most of the pine stands in this condition range in age from 30 to 60 years and most hardwood stands range from 50 to 100 years. Volumes per-acre vary with the number and size of trees and forest type, but average volumes per acre in uncut stands range from 2,920 board feet in the upland hardwoods type to 6,020 in the cypress - white-cedar species association. Partly-cut stands vary from 2,120 to 5,460 feet in the same types. Approximately one-fourth of the second-growth saw timber has been partially cut-over for particular species or sizes, a process that has affected the upland hardwoods type to the largest degree and the bottom-land hardwoods the least. On the basis of the sample plots recorded by the Forest Survey in each county over three-fourths of the forest in James City, Mathews, Princess Anne, and Southampton counties is second-growth saw timber, with smaller proportions in the other counties.

Cordwood stands: Young second-growth timber occupies 1.3 million acres, 33 percent of the forest land. Stands in this classification contain less than 600 board feet per acre and are predominantly young growth from 1.0 inch d.b.h. to saw-timber size (pines 9.0 inches d.b.h. and hardwoods 13.0 inches d.b.h.). Forty-three percent of this young second growth is in the loblolly pine type and 29 percent is in the upland hardwoods type, the remaining acreage is chiefly bottom-land hardwoods and Virginia pine. Most of these young stands are less than 30 years old, although many stands of hardwoods require at least 50 years to reach an average diameter of 13.0 inches d.b.h. Volume-per-acre of these young

stands are best expressed in cords and the average volume in trees 5.0 inches d.b.h. and larger varies from less than a cord in the cypress - white-cedar type to 7 cords in the upland hardwood type. The loblolly pine type averages 5.5 cords over 548,800 acres.

Reproduction: The reproduction condition class is limited to 165,800 acres, 4 percent of the forest land. This does not mean that reproduction is scarce in the forests of coastal Virginia, rather it means that all but this relatively small acreage is stocked to some degree with trees larger than 1.0 inch in diameter and consequently was classified in a higher category. Reproduction, as such, is present in most of these older stands. About 55 percent of the land stocked only with reproduction is coming back to loblolly pine, 20 percent to bottom-land hardwoods, and 14 percent to Virginia pine. Undoubtedly there must be some clear-cut areas not restocking to any species but they are not abundant as none were recorded by the Forest Survey.

Old growth: Old growth is the least extensive of the forest conditions, occupying only 111,900 acres, about 3 percent of the forest land. Settlement and land clearing for 300 years have removed practically all of the original virgin timber and most of the pine stands classified as old growth are in reality second-growth timber that has restocked abandoned fields more than 100 years ago. The major exception is the old-growth hardwood timber in the Dismal Swamp.

Site Quality

The soils and climate of eastern Virginia are conducive to rapid tree growth. Site quality, which is chiefly determined by these natural factors, is therefore high. It is measured in several ways, but a commonly used index for southern pine is the height of average dominant trees at 50 years of age. In table 5 the area of each of the pine types is classified into three degrees of site quality as follows: good -- land capable of growing loblolly pine trees 80 or more feet and Virginia and shortleaf pine 70 or more feet in height at 50 years of age; fair -- land capable of growing loblolly pine 60 or 70 feet in height and Virginia and shortleaf pine 60 feet; poor -- land capable of growing pine trees 50 feet or less in height.

Over 2 million acres, 87 percent, of the land stocked with pine is of fair to good site quality (table 5). Trees growing on this land will be tall, thrifty, well-formed and when merchantable will yield several sawlogs. Land stocked with loblolly pine is most productive and land in the shortleaf pine types, 40 percent of poor site, is least productive. A separate analysis of all old-field and forest-grown pine stands revealed that abandoned fields were less productive than forest soils, for the proportionate area in poor sites was nearly twice as large in the old-field stands as in forest-grown stands.

The hardwood land not shown in the table, was classified as good, fair, or poor using soil and moisture conditions and merchantable height

Table 5. - Land in pine types classified according to site quality, 1940

Forest type and site index class	Land in types	
	Acres	Percent
Loblolly pine		
Good	496,300	25.9
Fair	1,275,000	66.4
Poor	148,100	7.7
Total	1,919,400	100.0
Virginia pine		
Good	77,900	23.5
Fair	153,800	46.5
Poor	99,100	30.0
Total	330,800	100.0
Shortleaf pine		
Good	42,000	25.6
Fair	55,400	33.8
Poor	66,700	40.6
Total	164,100	100.0
All pine types		
Good	616,200	25.5
Fair	1,484,200	61.5
Poor	313,900	13.0
All sites	2,414,300	100.0

and form of trees as criteria of site quality. Sites were found to be poorest in the swamps and best in the well-drained alluvial soils along the rivers. About 96 percent of the 1.5 million acres stocked with hardwood were classified as of fair to good site quality.

Age of Stands

The pine forests of coastal Virginia are composed of both even-aged and all-aged stands. Most of the even-aged stands have originated upon abandoned fields, frequently during a single good seed year. At least one-third of the stands are in this category. All-aged stands may consist of two or three distinct age classes, presenting a multi-storied appearance, or they may be composed of many small groups of even-aged trees. This latter is the more usual form. Most of the pine stands reach minimum saw-timber size at about 30 years of age. On this basis the pine forest is in balance from an age-class distribution standpoint as about one-half of the pine type area supports stands more than 30 years old (fig. 9). If there is a deficiency it is in the stands over 60 years of age, which occupy less than one tenth of the pine area.

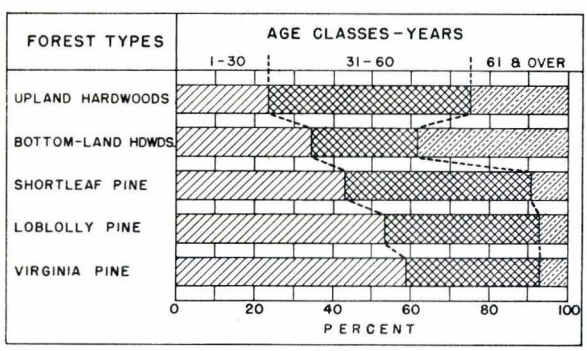

FIGURE 9 - DISTRIBUTION OF FOREST TYPE AREAS BY AGE CLASS, 1940.

Hardwood stands are usually all-aged, containing reproduction, saplings, and saw-timber trees. The occasional even-aged stands are sweetgum or yellowpoplar on abandoned fields, old-growth timber without an understory of young growth, and second-growth black tupelo. Only 30 percent of the hardwood type area supports stands over 60 years old, the minimum age of saw timber, but the age-class distribution in both the upland and bottom-land hardwoods is suitable for the continuous production of saw timber.

Stocking

Number of stems and volume of timber per acre vary widely between forest stands of the same age. Some of the old-field stands which have come in on small abandoned fields adjacent to a good source of seed are so densely stocked that growth is slow. On large abandoned fields the natural restocking has often been scattered and sparse and the subsequent stand is very poorly stocked. Forest fires have also destroyed many young trees in both old-field and natural-forest stands thus causing a lower degree of stocking.

Table 6. - Average volumes per acre in the uncut conditions of the pine types, 1940

Age class	Best 10 percent of stands	Average stands	Stocking of average stand
Years	Cords	Cords	Percent
11-20	7.6	3.1	41
21-30	22.2	10.2	46
31-40	35.6	18.5	52
41-50	43.6	23.6	54
51-60	47.6	26.0	55
61-70	49.6	27.2	55
71-80	51.1	27.6	54
81-90	52.1	27.8	53
90+	52.6	27.8	53
Average	35.8	18.2	51

In general the average pine stand is only one-half stocked (table 6) if we assume that the best 10 percent of the stands in the uncut conditions represent full stocking. MacKinney and Chaiken[1/] determined that fully stocked stands of 65-year-old loblolly pine on a 75-foot site in Virginia and North Carolina contained about 51 cords per acre. This compares with 49.6 cords for the best 60- to 70-year-old stands in table 6. The degree of stocking in the average stand remains fairly constant from age class to age class and the culmination of rapid volume increase in both fully stocked and average stands appears to be at 70 years of age.

1/MacKinney, A. L., and Chaiken, L. E., 1939. Volume, Yield, and Growth of Loblolly Pine in the Mid-Atlantic Coastal Region. App. For. Exp. Sta. Tech. Note 33.

VOLUME OF THE FOREST RESOURCE

The following estimates of the amount of sound wood in the Coastal Plain of Virginia in 1940 include the volume of all living trees 5.0 inches d.b.h. and larger. Saw timber consists of softwood trees 9.0 inches d.b.h. and larger and hardwood trees 13.0 inches d.b.h. and larger. Cordwood trees of both species groups range from 5.0 inches d.b.h. to sawlog size.

Volumes are measured in three forms: board feet, cords, and cubic feet. The volumes expressed in board feet include only the sawlog portion of saw-timber trees. Cordwood volumes (wood and bark) include sawlogs, the upper stems of softwood saw timber, and the sound stems of cordwood trees. Cubic-foot volumes do not include bark, otherwise the basis of estimate is the same as for cordwood. The sound volume in cull trees and the upper stems and limbs of hardwood saw timber is shown in cords in figure 13 and table 29 and in cubic feet in table 32, to provide an estimate of the total volume of sound wood.

The softwood species group includes loblolly, shortleaf, Virginia, and pond pines, cypress, Atlantic white-cedar, and redcedar. There is a very small quantity of pond pine and for this reason it is combined with loblolly pine. The small quantity of white-cedar and redcedar is combined with cypress.

The hardwood species group includes all the hardwoods native to the region except noncommercial species such as scrub oak, blue beech, red bud, and sassafras. In the Appendix tables the red oaks and the white oaks have each been grouped into two classes, poor and good, because of quality differences in the species. Poor red oaks include black, scarlet, water, willow, and southern red, species which usually produce less high-grade material than swamp red oak, the major species in the good classification. Overcup and post oaks are of poor quality compared to swamp chestnut oak and forked-leaf white oak, although it is recognized that broad generalizations do not always apply correctly to individual trees. Tupelos include both black and water tupelo, species known to the lumber trade as blackgum and tupelo gum. All species of hickory are grouped together, no single species being particularly abundant.

Board-Foot Volume

In 1940 the net volume of saw timber amounted to 11.7 billion board feet by the International $\frac{1}{4}$-inch rule, which is used throughout this report unless otherwise specified. According to the Doyle rule, which is in common use throughout Virginia, the net volume was only 7.3 billion feet.

By species: Two-thirds of the saw timber is softwood, chiefly loblolly pine. As shown in figure 10 there are nearly 7 billion feet of this species alone, and it accounts for 58 percent of all the saw-timber volume. By comparison the other species appear unimportant as a

source of saw timber but, in the aggregate they amount to nearly 5 billion feet, forming a significant part of the saw-timber stand. White-cedar is limited to the Dismal Swamp and the total volume is not over 8 million board feet. About 25 percent of the red oak saw timber and 88 percent of the white oak is in the more desirable species.

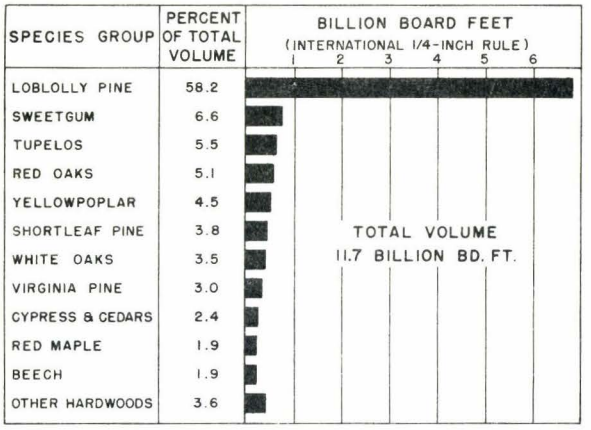

FIGURE 10 - THE VOLUME OF SAW TIMBER BY SPECIES, 1940.

By forest condition:
The softwood saw timber is almost entirely second growth for 92 percent is in second-growth saw-timber stands and 2 percent is in saw-timber trees scattered throughout young cordwood stands. Only 6 percent is old growth, chiefly loblolly pine.

Old growth stands are a better source of saw timber in the hardwoods, for 18 percent of the volume is in these mature forests. About two-fifths of this old-growth volume is black and water tupelo. Eighty percent of the hardwood volume is in second growth saw-timber stands, and in these sweetgum alone accounts for nearly one-fourth of the saw timber. Cordwood stands contain only 2 percent of the volume and this is chiefly sweetgum, good-quality white oak, poor-quality red oak, and yellowpoplar.

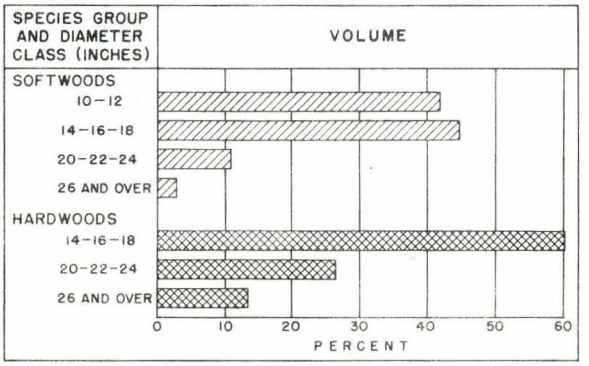

FIGURE 11 - DISTRIBUTION OF NET BOARD-FOOT VOLUME BY SPECIES GROUP AND DIAMETER CLASS, 1940.

By diameter class:
Nearly 15 percent of the softwood saw-timber volume is in trees larger than 19.0 inches d.b.h. and nearly 60 percent is in trees above 13.0 inches in diameter (fig. 11). This is a rather high proportionate volume in large trees, since most of the stands are less than 60 years old. Rapid growth on good sites is a contributing factor but it also indicates that the pressure for softwood saw timber was not excessive up to 1940.

A different relationship exists in the hardwoods because they are not considered saw timber below 13.0 inches in diameter. Forty percent of the volume is in trees over 19.0 inches d.b.h. About one-half of the volume in these larger trees is composed of sweetgum, tupelos, and yellowpoplar.

Volumes-per-acre: Commercial utilization of the saw timber depends, in part, upon the distribution of the board-foot volume on the forest land. In practice sawmill operators usually must be assured of a certain minimum total volume before they will set up a mill, but this really means that the stand-per-acre on the land within economical hauling distance must be great enough to provide the required quantity of logs. Small portable mills frequently log stands averaging only a few hundred feet per acre, but most operators prefer at least 2,000 feet.

Most of the board-foot volume in the saw-timber conditions is operable. Stands stocked with less than 2,000 feet per acre occupy 28 percent of the land in the softwood types but they contain only 7 percent of the saw timber, leaving 93 percent of the softwood volume concentrated on 72 percent of the land averaging more than 2,000 feet (fig. 12). Actually, 37 percent of the softwood volume is in stands averaging 10,000 feet and over per acre.

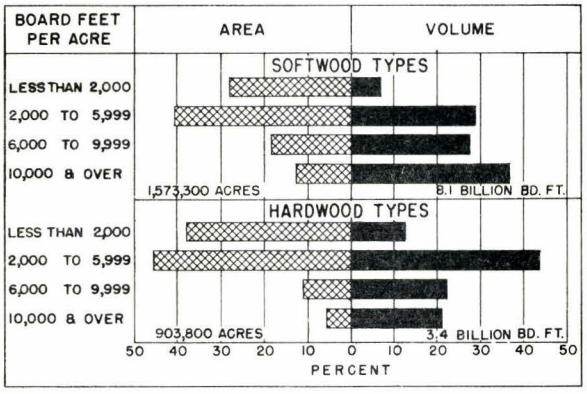

FIGURE 12 - DISTRIBUTION OF AREA AND BOARD-FOOT VOLUME (INT. 1/4-IN. RULE) IN THE SAW TIMBER CONDITIONS BY VOLUME-PER-ACRE CLASS, 1940.

The hardwood volume occurs in lighter stands per acre. Stands of less than 2,000 feet occupy 38 percent of the hardwood type area and contain 13 percent of the hardwood volume. Forty-four percent of the volume is in stands of 2,000 to 6,000 feet per acre and only 21 percent is in stands of 10,000 feet and over.

About one-fourth of the total saw-timber area is stocked with more than 6,000 feet per acre, and these stands contain three-fifths of the board-foot volume.

Table 7. - Average board-foot volume[1/] per acre by forest type and class of stand, 1940

Forest type	Saw-timber stands	Cordwood stands	All stands
	Bd.ft.	Bd.ft.	Bd.ft.
Loblolly pine	5,530	180	3,740
Virginia pine	2,900	130	1,570
Shortleaf pine	3,380	230	2,040
Cypress-cedar	8,340	-	6,310
Upland hardwoods	2,940	240	1,810
Bottom-land hdwds.	4,760	180	3,250
All types	4,630	190	3,000

1/ International 1/4-inch rule.

The average volume per acre, including both saw-timber and cordwood stands, is 3,000 board feet (table 7). White-cedar saw-timber stands have the largest average volume per acre but there are only a few thousand acres left and these are being cut over rapidly. One-half of the total saw-timber area is stocked with stands of loblolly pine

which average 5,530 feet per acre, ranging from an average of 3,920 in partly-cut second growth to 14,910 in old growth timber.

Cordwood Volume

The total volume of all sound trees is 60 million cords excluding culls and the upper stems and limbs of hardwood saw timber. Nearly 30 million cords are contained in the sawlog portion of saw-timber trees and 4 million cords are contained in the upper stems of softwood saw timber. Small trees below saw-timber size amount to 26 million cords. With the addition of over 8 million cords of sound usable wood in cull trees and nearly 6 million cords of wood in the upper stems and limbs of hardwoods the total amount of wood in all trees is 74 million cords (table 29, Appendix).

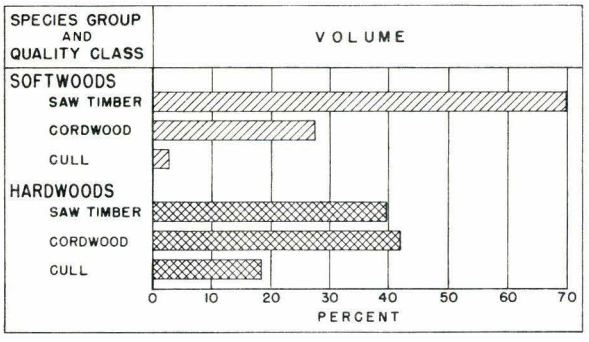

FIGURE 13- DISTRIBUTION OF TOTAL CORDWOOD VOLUME BY TREE-QUALITY CLASS, 1940.

By quality class: Forty-six percent of the total cordwood volume is softwood, altogether 34.1 million cords. There are 23.8 million cords in saw-timber trees; 19.5 million in sawlogs and 4.3 million in the upper stems. Young cordwood trees contain 9.3 million cords and cull trees only one million. Eighty-two percent of the total softwood volume is loblolly pine.

Fifty-four percent, 40.2 million cords, of the total cordwood volume is hardwood. Saw-timber trees contain 15.9 million cords, two-thirds in sawlogs and one-third in upper stems and limbs (table 29, Appendix). The volume of young trees, 16.9 million cords, is greater than the volume of saw-timber trees. There are 7.4 million cords of cull hardwoods, 18 percent of the entire hardwood volume and 10 percent of the total volume of sound wood in all species. Two-fifths of this cull volume is tupelo and red maple, both suitable for certain kinds of pulp. Nineteen percent of the total hardwood volume is sweet gum, but the tupelos, white oaks, red oaks, and yellowpoplar also account for a large proportion of the cordwood volume.

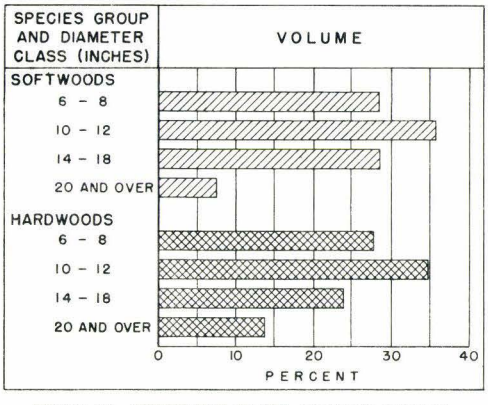

FIGURE 14- DISTRIBUTION OF NET CORDWOOD VOLUME IN SOUND TREES BY DIAMETER CLASS, 1940.

By diameter class: The distribution by diameter class of the volume in all sound trees, 60 million cords, is indicated in figure 14. There is a close similarity in volume

distribution between species groups, the chief difference occurring in the largest diameter class of the hardwoods. This is because of the rather high proportion of old growth in the bottom-land hardwoods type. Including all species there are 16.8 million cords in the 6- and 8-inch class, 21.2 million cords in the 10- and 12-inch class, 15.9 million in the 14-, 16-, and 18-inch class, and 6.1 million in the 20-inch and over class.

Table 8. - Average cordwood volume per acre by forest type and class of stand, 1940

Forest type	Saw-timber stands	Cordwood stands	All stands
	Cords	Cords	Cords
Loblolly pine	23.6	4.7	17.3
Virginia pine	16.9	4.4	10.9
Shortleaf pine	18.8	6.3	13.4
Cypress-cedar	32.2	0.1	24.4
Upland hardwoods	16.1	7.0	12.3
Bottom-land hdwds.	21.7	3.9	15.8
All types	21.2	5.2	15.3

Volume-per-acre: The average volume of wood per acre, excluding culls and upper stems and limbs of hardwoods, is 15.3 cords. This is the average of all forest types and conditions, including reproduction.

Saw-timber stands average 21.2 cords per acre. Average volumes range from 53.3 cords per acre in old growth cypress-cedar to 13.7 cords in partly cut stands of upland hardwoods. Loblolly pine saw timber averages 23.6 cords per acre over 1.3 million acres, one-third of all the forest land.

Cordwood stands have an average volume of only 5.2 cords per acre, representing the stand on 1.4 million acres of land. The extremely small volume in the cypress-cedar type is not significant because less than 10,000 acres are involved.

Cubic-Foot Volume

The net volume of sound wood, without bark, in all trees 5.0 inches d.b.h. and larger is summarized in cubic feet in table 9. Forty-eight percent of the volume is softwood and 52 percent hardwood. Of the softwood volume, 71 percent is in saw-timber trees, 26 percent is in cordwood trees, and only 3 percent is in cull trees. By contrast only 40 percent of the hardwood volume is in saw-timber trees, 41 percent is in cordwood trees, and 19 percent is in cull trees.

Table 9. - Net cubic-foot volume of all sound wood by species group and quality class, 1940

Quality class	Softwoods	Hardwoods	All species	
	M cu. ft.	M cu. ft.	M cu. ft.	Percent
Saw timber:				
Sawlogs	1,368,910	676,600	2,045,510	41.9
Upper stems	297,260	342,340	639,600	13.1
Total	1,666,170	1,018,940	2,685,110	55.0
Cordwood	609,490	1,039,380	1,648,870	33.8
Cull trees	68,670	478,590	547,260	11.2
All classes	2,344,330	2,536,910	4,881,240	100.0

Poles

A great number of pine poles and piles are cut each year from the forests of coastal Virginia. Many are used locally in telephone and power lines and in docks, bridges, shipyards and foundations, while others are shipped to the large cities of the northeast. The Forest Survey did not tally the number of pine trees suitable for piles, but an estimate was made of the number of trees suitable for poles (table 33, Appendix). The length-class distribution of the estimated 21 million poles is indicated in figure 15. Short poles predominate, but nearly 20 percent of the pole stand will make poles 35 feet or over in length. This is an unusually high proportion.

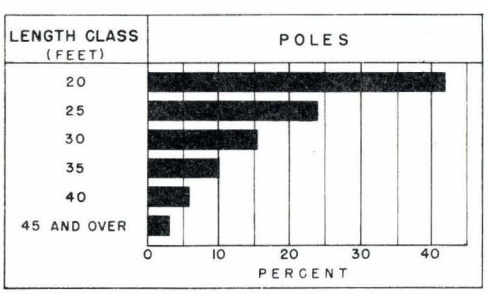

FIGURE 15- DISTRIBUTION OF PINE POLES BY LENGTH CLASS, 1940.

THE PRIMARY FOREST INDUSTRIES

The forests of coastal Virginia provide raw material for a great variety of primary wood processing plants. Sawmills predominate but 88 other plants manufacture veneer and packages, various kinds of cooperage, excelsior, pulp and paper, handles, and other products. Large quantities of fuel wood and fence posts are cut each year, as well as poles, piles, and hewn crossties. About 2 million cords of sound wood were cut from the forest in 1940 for conversion into these various products, and their harvesting and manufacture provided nearly 17,000 man-years of employment.

The Lumber Industry

On the basis of a mill-to-mill canvass made in 1941 throughout Virginia, the 567 sawmills operating in the Coastal Plain cut 46 percent of all the lumber produced in the State. In doing so they accounted for 66 percent of the drain upon the saw-timber growing stock and provided 28 percent of the woods and plant employment in the forest industries of the coastal area. Small sawmills are the rule, however, for 506 of the mills had a cutting capacity of less than 10,000 board feet per day and 49 had a capacity of only 10,000 to 20,000 feet. Only 12 mills could normally cut more than 20,000 feet per day, but 3 of these had a combined productive capacity of 215,000 board feet each 8 hours. Altogether the 567 mills cut 492 million feet, 85 percent softwoods and 15 percent hardwoods. In 1941 sawmills cut about 585 million feet of lumber, nearly a 20 percent increase over the previous year.

Table 10. - Lumber production by capacity class of sawmill and species group, 1940

Rated capacity in 8 hours	Mills	Softwoods	Hardwoods	All species groups	
M bd. ft.	Number	M bd. ft.	M bd. ft.	M bd. ft.	Percent
1-9	506	241,200	33,800	275,000	55.9
10-19	49	76,500	10,400	86,900	17.7
20-39	9	42,600	4,400	47,000	9.5
40 & over	3	58,000	25,300	83,300	16.9
All mills	567	418,300	73,900	492,200	100.0

Mills of 1-9 M capacity: The 506 small sawmills (table 10) produced 56 percent of the lumber. They were responsible for almost the entire 20 million feet of lumber cut from Virginia pine and they also cut more oak than the larger mills, accounting for 20 of the 26 million feet.

Three-fourths of these mills changed location an average of three times during 1940. The other one-fourth could be moved but for various reasons they remain in the same place year after year. Forty-eight percent of the mills used steam power, 40 percent used gasoline units, or old automobile engines, 11 percent used Diesel units, and 1 percent, only

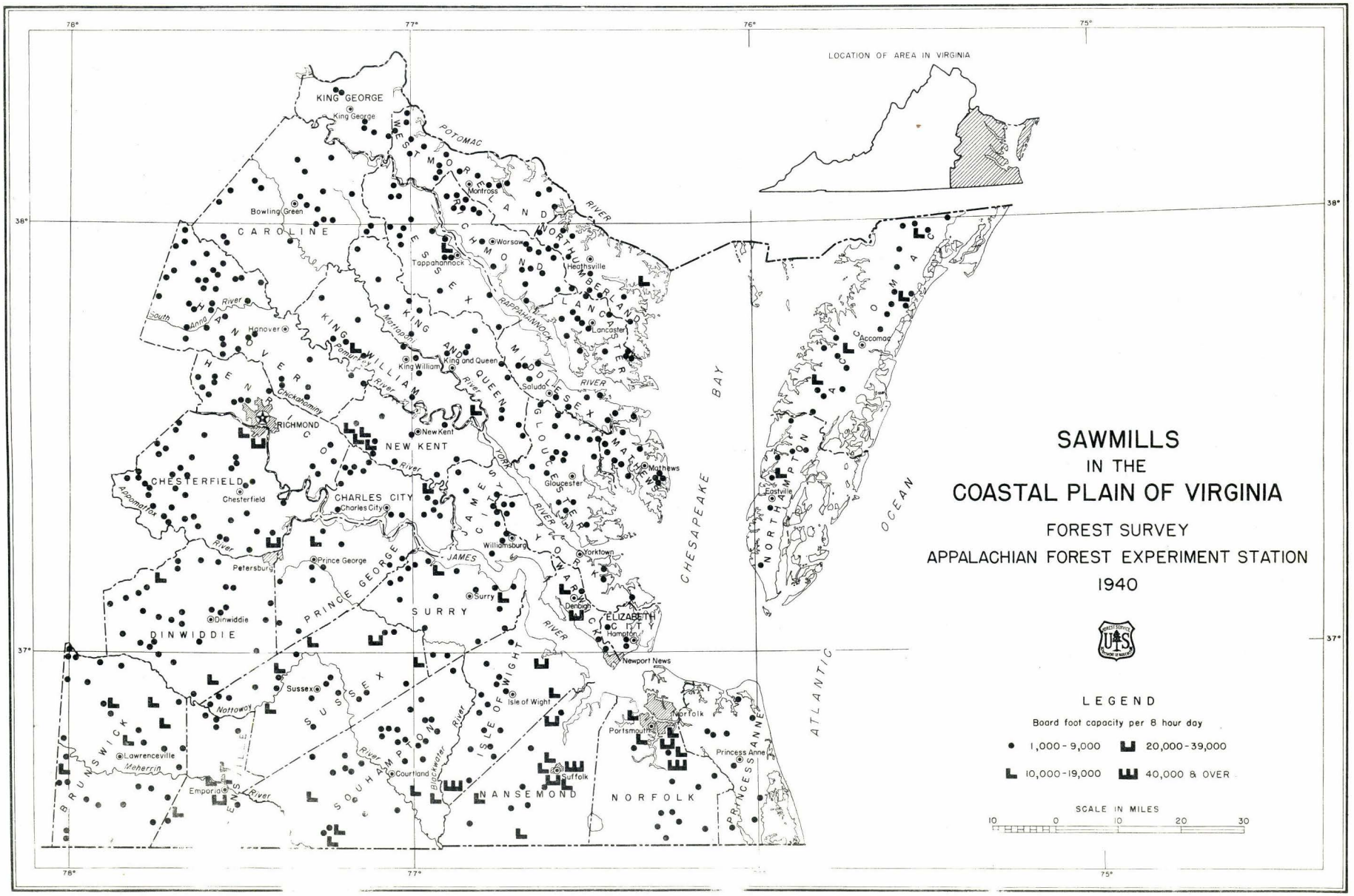
LOCATION OF AREA IN VIRGINIA
SAWMILLS
IN THE
COASTAL PLAIN OF VIRGINIA
FOREST SURVEY
APPALACHIAN FOREST EXPERIMENT STATION
1940
LEGEND
Board foot capacity per 8 hour day
1,000 - 9,000
10,000 - 19,000
20,000 - 39,000
40,000 & OVER
SCALE IN MILES
10 0 10 20 30
KING GEORGE
WESTMORELAND
NORTHUMBERLAND
LANCASTER
RICHMOND
ESSEX
KING AND QUEEN
KING WILLIAM
MIDDLESEX
GLOUCESTER
MATHEWS
CAROLINE
HANOVER
HENRICO
NEW KENT
CHESTERFIELD
CHARLES CITY
JAMES CITY
YORK
ACCOMAC
NORTHAMPTON
PRINCE GEORGE
SURRY
DINWIDDIE
ELIZABETH CITY
SUSSEX
BRUNSWICK
SOUTHAMPTON
ISLE OF WIGHT
NANSEMOND
NORFOLK
PRINCESS ANNE
POTOMAC
RAPPAHANNOCK
CHESAPEAKE BAY
ATLANTIC OCEAN
78°
77°
76°
75°
38°
37°

FIGURE 16

four mills, used electric power (table 34, Appendix). Practically all of the mills had belt feed, although four had an auxiliary steam feed to step-up their production. All of the mills used circular saws, a very few had resaws, 35 percent had edgers, 8 percent had trimmers, 12 percent had planers, and only 3 mills operated dry kilns. Rough green lumber, much of the softwood cut 2 inches thick, was the major product.

Table 11. - Source of sawlogs, in percent, at mills of four capacity classes, 1940

Source	Rated capacity M bd. ft. in 8 hours				All mills
	1-9	10-19	20-39	40+	
Land owned	9	10	10	60	18
Stumpage purchased	67	51	61	26	56
Logs purchased	4	23	29	14	12
Contract sawing	18	16	-	-	13
Custom sawing	2	negl.	-	-	1

About two-thirds of the sawlogs used by these small mills were purchased as stumpage (table 11) and one-fifth of the logs were sawed under contract at a fixed rate per thousand feet of lumber produced. Custom sawing was relatively unimportant and very few logs were purchased delivered at the mill, but it is somewhat unusual to find that small mill operators obtained nearly 10 percent of their sawlogs from their own land.

Most of the logging was accomplished through the use of animal power in the woods, and trucks on the highway hauls. Animals were used for bunching on 98 percent of the logging operations, with mules twice as numerous as horses (table 35, Appendix). Only seven operators used tractors for bunching although five used them for skidding direct to the mill. High wheels were used for the short haul, which was either directly to the mill or to a loading point, on 94 percent of the operations. Here again animals were the favored motive force, with tractors in use on only 20 logging jobs. The average length of the short haul was one-third of a mile. Logs were hauled more than one mile to the mill on only 15 percent of the operations. Practically all of this hauling was by motor truck over an average one-way distance of six miles. On the average operation 6 men were employed in the woods and 6 in the sawmill.

Mills of 10-19 M capacity: Thirty-four of the 49 mills in this capacity class were located south of the James River. The total cut of all these mills was about 87 million feet of lumber, 18 percent of the total. The softwood was chiefly loblolly pine and over one-half of the 10 million feet of hardwood was sweetgum, black tupelo, and yellowpoplar, the remainder was chiefly oak.

About 20 of these mills changed location during the year, moving an average of 4 times. Steam powered three-fourths of the mills, the rest used Diesel and gasoline units. A majority had belt feed, but 16 had auxiliary steam and 3 had the standard shotgun feed. Circular saws were in use at 43 of the mills and 6 used band saws. A few mills had resaws, edgers were standard equipment, but only one-third used trimmers and planers. Dry kilns were operated at seven mills.

Operators of these mills purchased about one-half of their sawlogs as stumpage and bought nearly one-fourth delivered at the mill yard. The rest were obtained from land they owned and from stumpage logged and sawed under contract. Animal logging was most common, as 92 percent of the mills used animals for bunching and all of them used high wheels and animals for the short haul which averaged two-fifths of a mile at two-thirds of the mills. A few operators skidded directly to the mill with small gasoline skidders. Logs were hauled an average distance of 10 miles to one-half the mills. Trucks were used on all these operations, supplementing railroad haul in two instances. Employment at the average mills of this size-class was provided to 11 men in the woods and 13 in the sawmill.

Mills of 20-39 M capacity: Eight of the nine mills in this class were located south of the James River. Altogether they cut 47 million board feet of lumber, nearly 10 percent of the total production. Ninety percent of the lumber was softwood, chiefly loblolly pine, and the remaining hardwood was mostly yellowpoplar, oak, and sweetgum.

These mills are stationary. Eight of them were steam powered and had shotgun or auxiliary steam feeds. The one electric mill had a belt feed. Bandsaws, edgers, and trimmers were the usual equipment but only four mills were equipped with planers, and only six had dry kilns.

Six-tenths of the sawlogs for these mills were purchased as stumpage, three-tenths were purchased delivered at the mill, and one-tenth were obtained from land owned by the mill operators. Animals were used for bunching logs on most operations but tractors were used in at least two instances. Six operators used high wheels pulled by animals or tractors on short hauls averaging one-half mile and trucks were used to haul the logs an average distance of 14 miles from the woods to the sawmill. Thirty-seven men worked on the average woods operation and 34 were used in the mill.

Mills of 40 M and over capacity: Three of the 4 mills in the State with a capacity of 40,000 or more feet per day are located in the Costal Plain, in Isle of Wight, Nansemond, and Norfolk counties. Capacities of these three mills ranged from 40,000 to 100,000 board feet each 8 hours. They cut 83 million feet in 1940, 17 percent of the total lumber cut. Seventy percent of the production was softwood and 30 percent hardwood. They cut three-fourths of the cypress and white-cedar produced in the area as well as most of the black and water tupelo and soft maple.

These mills were all steam powered, with shotgun feeds, band saws, and a full complement of equipment for making graded, kiln-dried lumber of good quality. Sixty percent of the sawlogs were obtained from company-owned lands, 26 percent were purchased stumpage, and 14 percent were bought on the mill yard. All three companies obtained sawlogs from the Dismal Swamp and two own large acreages of forest land in the Swamp in Virginia and North Carolina. Steam skidders were used in logging the Swamp, and tractors and mules were used on the drier ground. Trucks hauled all the sawlogs for one mill and part of the logs for the other

two. These two larger mills were supplied by logging railroads and one also obtained logs by barge. The average haul for the three mills was 48 miles. The number of employees varies widely between individual operations, but averages 445 for both woods and mill, exclusive of the planing-mill employment.

Lumber cut by tree-diameter class: Numerous studies in various timber types and forest regions have demonstrated that logging and milling costs can be reduced and lumber values can be increased by restricting the cut to the trees of larger diameter, a practice that will generally leave a growing stock of young small trees as a basis for future operations.

Table 12. - Distribution of lumber cut and total saw-timber stand by species group and tree-diameter class, 1940

Species group and diameter class (inches)	Lumber cut	Saw-timber stand
	Percent	Percent
Softwoods:		
6-8	1	-
10-12	14	41
14-16-18	44	45
20+	41	14
Total	100	100
Hardwoods:		
10-12	3	-
14-16-18	34	60
20+	63	40
Total	100	100

Studies made on the cutting areas of about one-half the sawmills indicate that the lumber industry was obtaining a large proportion of its cut from the larger trees, as 85 percent of the softwood was cut from trees over 13.0 inches in diameter and 63 percent of the hardwood was cut from trees over 19.0 inches in diameter (table 12). The proportionate cut from the smaller trees was appreciably less than their occurrence in the saw-timber stand, resulting, as far as the lumber industry is concerned, in a gradual increase in this class of growing stock. On the other hand, the proportionate cut from trees above 19.0 inches in diameter in both the softwoods and hardwoods was in excess of the proportionate saw-timber volume in these larger trees. This is not necessarily bad practice, but it does tend to reduce the average diameter of saw timber by causing a gradual reduction in the quantity of large-sized growing stock. In less than 10 years the volume recruited from the smaller trees will begin to compensate for this overcutting.

Employment in lumber industry: In 1940 over 9,000 people were employed by the lumber industry, not including those working in dry kilns and planing mills (table 13). Only the larger mills provided full-time employment, however, for the mill cutting less than 10,000 board feet per day operated an average of only 101 days and the mills cutting 10,000 to 19,000 board feet averaged 164 days. The total employment in woods and sawmills, exclusive of dry kilns and planing mills, amounted to 1.2 million man-days, equivalent to 4,800 man-years of 260 days each.

Table 13. - Employment in the lumber industry by capacity class of sawmill, 1940

Item	Rated capacity M bd. ft. in 8 hours			
	1-9	10-19	20-39	40+
	Number	Number	Number	Number
Avg. operating time:				
Shifts or days	101	164	223	389
Avg. number employees:				
On logging operation	6	11	37	267
In sawmill only	6	13	34	178
Total	12	24	71	445
Total employees:[1]				
In woods	3,036	529	333	801
In sawmills	3,187	613	301	535
Total	6,223	1,142	634	1,336
Man-hours per 1,000 bd. ft.:				
In woods	9.5	9.1	14.3	19.2
In sawmill	10.3	10.5	12.2	12.2
Rough lumber	19.8	19.6	26.5	31.4
Add for drying & finishing	6.7	5.5	7.0	9.0
Total	26.5	25.1	33.5	40.4
Total man-days:[2]				
In woods	316,200	90,100	72,200	90,900
In sawmills only	354,100	114,100	71,700	127,000
Total	670,300	204,200	143,900	217,900

1/ Total employees - 9,335.

2/ Total man-days - 1,236,300, equivalent to 4,800 man-years of 260 days.

Two-thirds of the workers were employed at the small mills cutting less than 10,000 board feet per day. These mills produced 1,000 feet of rough lumber with about 20 man-hours of labor for logging and milling and the limited number that made finished lumber used an additional 6.7 man-hours for drying and planing. Labor requirements were about the same in the mills of the 10,000 to 19,000 capacity class. More labor was required at the larger mills because logging conditions on the largest operations were difficult, the logs were hauled farther, most of the lumber was kiln dried, and a greater variety of carefully finished materials were produced.

Other Forest Products

More wood was used in nonlumber plants and for poles, piles, hewn crossties, fuel wood, and fence posts than for lumber. Eighty-eight plants, in addition to sawmills, were using wood as a primary raw material

Table 14. - Production in the nonlumber forest industries, 1940

Commodity	Plants	Produced or used
	Number	M bd. ft.
Veneer	7	23,100
		M cords
Nail kegs	37	76
Potato barrels	8	4
Misc. cooperage	3	6
Excelsior	19	41
Pulpwood	4	424
Handles	3	1
Misc. mfg. prod.1/	7	5
Fuel wood	-	1,179
		M pieces
Hewn crossties	-	275
Poles and piles	-	106
Fence posts	-	1,808
Total	88	--

1/Includes 3 wood-turning plants, 2 shingle mills, 1 box factory, 1 shuttle block mill.

in 1940. The four pulp mills at West Point, Hopewell, Franklin, and Jarratt were the largest but the most numerous were the 37 mills making nail keg staves (table 14). Other plants made excelsior, potato barrels, veneer, handles, and miscellaneous cooperage, while still others made products varying from wooden buttons to dogwood bearings for textile machinery. Altogether about 615,000 cords of wood were used in these plants and 1.3 million cords were used for fuel wood and other rough products. This was about 600,000 cords more than was used by the lumber industry.

Veneer: Nine veneer plants were in operation in 1940 but two of these made furniture veneers from imported woods and will not be considered further in this discussion. Of the remaining seven, one made furniture veneer, one made shipping cases for radios, refrigerators, and similar products, and five made fruit and vegetable baskets. These seven plants used 23 million board feet of logs measured by the International $\frac{1}{4}$-inch rule, or 18 million feet by the Doyle rule. About one-half of this wood was sweetgum, one-third was black and water tupelo, and the rest was chiefly yellowpoplar, loblolly pine, elm, cypress, and sycamore. One-third of the wood was cut from trees in the 14 , 16 , and 18-inch diameter classes and the rest came from larger trees. All of the veneer bolts were purchased delivered on the yard, one operator paying $15.00 per thousand feet Doyle scale for sweetgum and $25.00 for yellowpoplar.

Nearly 1,300 men were employed at these veneer plants which operated an average of 256 days in 1940. For each 1,000 board feet of logs consumed 119 man-hours were required in the mill to make the veneer and fabricate the finished cases and baskets. This contrasts with about 15 man-hours to log and deliver 1,000 board feet of veneer bolts or logs to the mill. Total woods employment amounted to 28,600 man-days.

Nail keg staves: Thirty-seven of the 42 plants making nail keg staves in Virginia in 1940 were located in the Coastal Plain, chiefly in Sussex, Southampton, and Surry counties (fig. 17). They used about 76,000 cords of wood, 98 percent loblolly pine and 2 percent yellowpoplar.

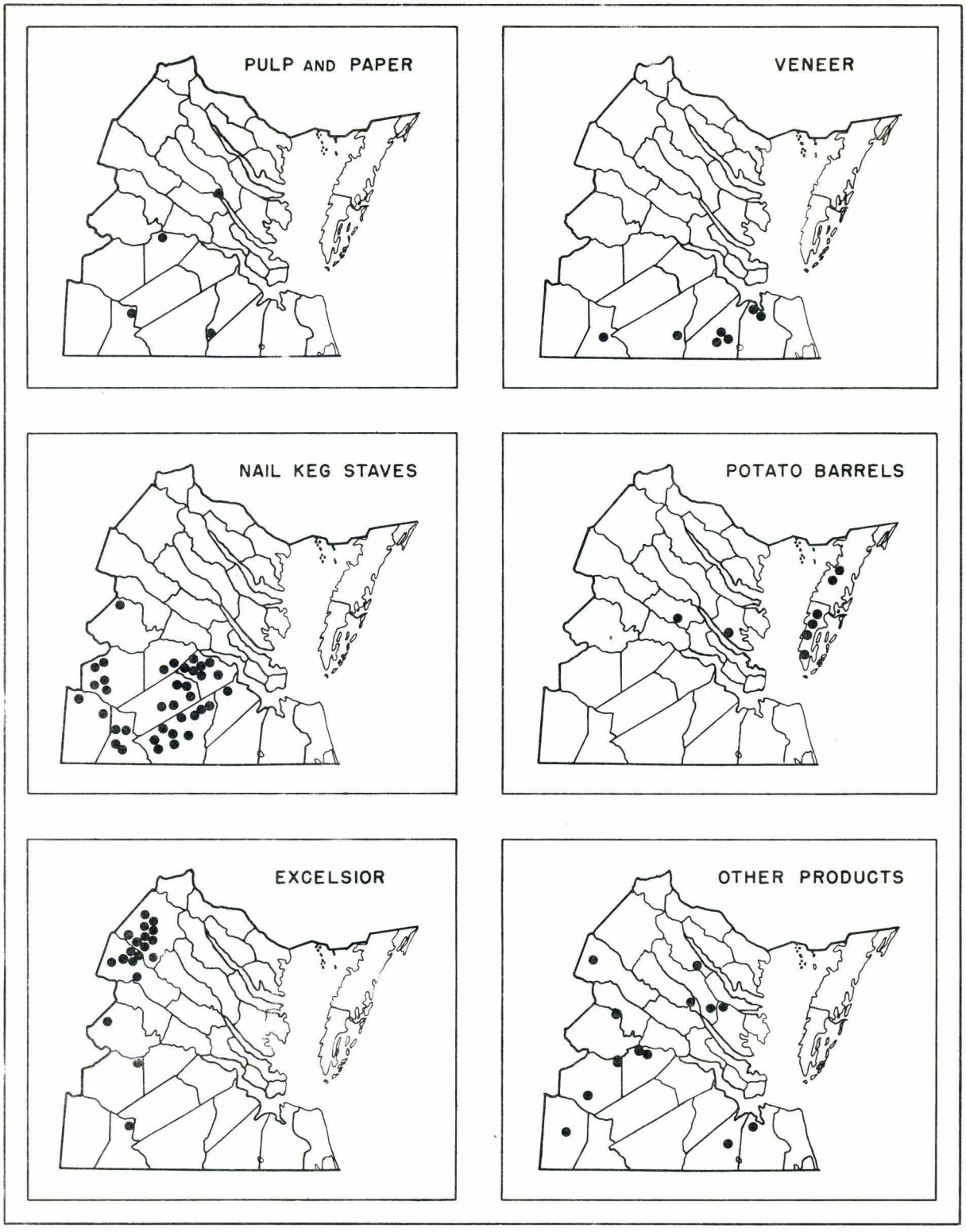

FIGURE 17 - APPROXIMATE LOCATION OF PRIMARY NONLUMBER FOREST PRODUCTS PLANTS, 1940.

Practically all of this wood was purchased as standing timber with payment on a lump sum basis. The stave operators cruise prospective tracts in terms of bundles and base their offer upon maximum stumpage values of 10 to 12.5 cents per bundle, equivalent to $1.60 to $2.00 per standard cord. Trees 8, 10, and 12 inches in diameter made up most of the cut, although the range of utilization extended from 6 to 20 inches. The timber used is of high quality, since the staves must be clear.

The most common lengths of staves are 17, 18, and 18½ inches, although they range in length from 15 to 21 inches. One standard cord of wood will make about 16 bundles of staves, or about 160 kegs. At this rate the 37 plants operating in 1940 made enough staves for 12 million kegs. These staves are shipped by rail, 850 to 1,000 bundles per car, to cooperage shops at the large steel mills where they are assembled with heading made in other plants. Most of the staves manufactured in Virginia are sent to Pennsylvania.

Most mills employ about 14 men, 4 in the woods and 10 in the mill. They usually work on a group-task basis with 125 to 150 pens set as a day's task, which they usually accomplish in less than 8 hours. Woods workers at each mill consist of one pair of fallers, one buncher, and one cart driver. Timber is skidded in long lengths and logging is at the rate of one standard cord every 3.9 man-hours. Mill workers cut staves at the rate of 14 bundles every 8 man-hours. Altogether, about 160 men were employed in the woods and 366 at the mills. In 1940 they worked an average of 229 days for a total of 121,100 man-days.

Potato barrels: Great quantities of Irish potatoes are grown on the Eastern Shore in Accomac and Northampton counties and many of them are marketed in barrels made in local cooperage plants. In 1940 there were four potato barrel plants in Northampton, two in Accomac, and one each in Gloucester and New Kent counties. They used 4,500 cords of loblolly pine, most of it cut from 10- and 12-inch trees. Six of the plants did their own logging and bought standing timber. The wood was hauled in 15-foot log lengths an average distance of 4 miles to the mills where it was cut into stave lengths of 28.5 inches. Two operators purchased 180 cubic-foot units of 5-foot wood delivered at the mill yard. Practically all of the timber was obtained from farm woodland.

The average plant gave employment to about 14 men, 8 in the mill and 6 in the woods. Operation is seasonal and the 65 plant employees and 50 woods workers were employed, on the average, only 54 days in 1940. For each cord of wood consumed, 6.3 man-hours of labor were expended in the mill and 5.0 in the woods, altogether 6,400 man-days.

Miscellaneous cooperage: These plants include a nail keg heading mill at Petersburg, a tight stave mill at Lawrenceville, and a tobacco hogshead mill at Cologne in King and Queen county. Altogether they used 5,800 standard cords of wood with the nail keg heading made from loblolly and shortleaf pine and yellowpoplar, the tight staves made from white oak, and the tobacco staves and heading made from loblolly and shortleaf pines. The pine and yellowpoplar were cut by local farmers and delivered

to the mills in 5-foot lengths with payment on the basis of 180 cubic-foot units. The operator of the tight stave mill bought stumpage from farmers and did his own logging.

Mill employees totaled 36 and they worked an average of 175 days, altogether 6,700 man-days. Almost as many men worked in the woods, for woods employment amounted to 5,200 man-days.

Excelsior: Virginia contains more excelsoir plants than any other state in the Nation. Nineteen of the 20 operating in Virginia in 1940 were located in this survey unit, particularly in Caroline and Hanover counties. They used 30,300 standard cords of peeled pine, chiefly loblolly equivalent to 41,000 cords of rough wood. Most of the wood was purchased from farmers and contractors for about $8.00 per unit of 180 cubic feet of peeled wood delivered at the mill, after an average haul of 10 miles. The individual bolts are cut five feet long and those four to six inches in diameter are preferred. The average plant consumed about five units of wood per day or 1,200 units per year. One unit of wood yields 1.25 to 1.5 tons of excelsior, therefore the total production in 1940 was about 30,000 tons.

The number of employees at excelsior mills varied from 4 to 12, but averaged about 7. The plants operating in 1940 gave employment to 130 men for an average of 233 days. Woods employment was distributed among many farmers, how many is not known. It takes about 12 hours to cut and deliver a standard cord of excelsoir wood and at this rate 58,300 man-days of woods employment were provided.

Pulp and paper: Sulphate pulp and kraft paper are manufactured by three large pulp and paper mills located at Franklin, Hopewell, and West Point. With a total capacity of 825 tons of sulphate pulp each 24 hours they account for three fourths of the sulphate and two-fifths of the total pulp capacity in Virginia. A fourth mill located at Jarratt makes 200 tons of groundwood pulp and 500,000 square feet of insulating board each 24 hours.

In 1940 these four mills consumed 423,700 standard cords of wood, including 31,200 cords of slabs purchased from sawmills. The round wood, 392,500 cords, was 80 percent loblolly and shortleaf pine and 20 percent Virginia pine. Less than 5 percent of the wood was obtained from thinnings on company owned land and the remainder was purchased. An estimated 60 percent was cut from farm woodlands. Approximately 25 percent of the pulpwood was cut from trees 6 and 8 inches in diameter, 59 percent was cut from 10- and 12-inch trees, and 16 percent came from larger trees. Pulpwood was brought into the mills by truck, railroad, and barge. The maximum length of haul was about 35 miles for trucks and 100 miles for barges and railroads. These long hauls give each mill a large operating territory and only a very small part of the forest land in the unit is not tributary to a pulp mill.

Over 1,900 employees worked at the four mills which operated an average of 348 days in 1940. For each cord of wood made into pulp and

paper 12.6 man-hours of labor were provided in the mills and an estimated 10 man-hours in the woods. The total woods employment amounted to 476,400 man-days, equivalent to 348 days of work for 1,400 men. Actually, many more pulpwood cutters worked a smaller number of days.

Handles: Three plants used about 1,000 cords of ash and 300 cords of hickory in the manufacture of handle blanks, tool handles, and baseball bats. Thirty-nine men were employed at these three mills where they worked an average of 166 days. Handle manufacture is a labor-consuming process and 49 man-hours were expended for each cord of wood consumed. Logging ash also takes considerable time because the trees are of scattered occurrence in mixture with other species. On one of the operations woods labor amounted to 11.3 man hours per cord, and on this basis 1,200 man days of woods employment were provided.

Miscellaneous manufacturing plants: Three wood-turning plants, 2 shingle mills, 1 box factory, and 1 shuttle block mill are included in this group. The turning plants made buttons and textile machine bearings of dogwood and paper roll plugs of pine, the shingle mills used white-cedar from the Dismal Swamp, the box factory made asparagus crates of pine, and the shuttle blocks were made of dogwood. Altogether about 170 cords of pine, 100 cords of dogwood and 1.4 million board feet of white-cedar were used. Almost 100 men worked in the plants and the estimated employment was 25,400 man-days in the mills and 6,800 man-days in the woods.

Fuel wood: In 1940 the total amount of fuel wood used was 1.2 million cords. This estimate represents the total fuel wood consumed by rural farm, rural nonfarm, small town, and urban families, and that used for curing tobacco. The rural use was obtained by contacting a proportion of the families in each rural category, according to a definite sampling procedure, to arrive at average consumption figures which were applied to the total number of families in each class. In the small towns the families were sampled and in addition the wood-yard sales were obtained. Fuel wood use in the larger cities was based directly upon sales reported by 73 wood yards with additions for the wood sold in town by farmers. The amount of wood used to cure 75,000 pounds of tobacco provided a factor of 2.87 standard cords per 1,000 pounds which was applied to the total production of tobacco. These methods do not give an exact measure of the fuel wood consumption but the results are the best obtainable with the funds and time available.

According to these estimates farm families used 715,000 standard cords, small-town families used 222,000, rural nonfarm families used 186,000, urban families used 33,000, and curing tobacco required 23,000 cords. The average farm family used 13.7 cords, the average rural nonfarm family used 7.8 cords, and the average small-town family used 5.5 cords. Fifty-five percent of all the fuel wood used was pine, and 45 percent was hardwood, chiefly oak. About 28 percent was slabwood obtained from sawmills, and 38 percent was cull and dead trees and topwood, leaving only 36 percent, 421,000 cords, which came from sound trees. Exclusive of the work involved in obtaining slabwood, about 1.3 million man-days of labor were required to produce the year's supply of wood.

Hewn crossties: The 275,000 hewn crossties produced in this survey unit in 1940 were one-half of all those cut in Virginia. Tie yards at Petersburg, Richmond, Fredericksburg, and Tappahannock purchased 137,000 ties for treatment at the wood-preserving plant at Massaponax, outside the unit in Spotsylvania. Other tie yards in Doswell, Richmond, Kilmarnock, Ayletts, and Petersburg purchased 90,000 and 27,000 were purchased by five railroads. All of these ties were oak for which one railroad paid the following prices F.O.B. shipping point: class 1 - 35 cents, class 2 - 45 cents, class 3 - 55 cents, class 4 - 75 cents, and class 5 - 90 cents. This same railroad purchased the following proportions of the different classes: class 1 - 5 percent, class 2 - 11 percent, class 3 - 15 percent, class 4 - 19 percent, and class 5 - 50 percent.

About 21,000 crossties were used in logging railroads, chiefly those operating in the Dismal Swamp. One-third of these were oak, one-third pine, and the rest cypress, cedar, black and water tupelos. All of these logging ties were cut from trees under 13.0 inches in diameter. About 48,100 man-days of labor were required to cut both the commercial and logging ties.

Poles and piles: About 106,000 poles and piles were cut from the forests of eastern Virginia in 1940. Three percent of them were trap stakes, 27 percent were poles, and 70 percent were piles. Pine trap stakes are used by fishermen to support nets in the water. They are from 40 to 85 feet long and from 5 to 10 inches in diameter, peeled, with the exception of the lower 5 feet. Many shorter and smaller stakes were also used but they are not included in this estimate because they are cut in small quantities all along the coast by fishermen.

Table 15. - Production of pine poles and piles by length class, 1940

Length class	Poles	Piles
Feet	Percent	Percent
20 - 25	22	14
30 - 35	52	16
40 - 45	23	25
50 - 55	2	24
60 - 65	1	13
70 & over		8
Total	100	100

Practically all of the poles were purchased by creosoting companies. Only a few thousand poles were obtained directly by railroad companies. All of the poles were pine and over one-half of them were 30 to 35 feet long (table 15).

The broken and extensive shoreline of coastal Virginia and the shipbuilding and seaport facilities of the Hampton Roads area create a local market for many piles. Also, this forest area, with the Eastern Shore of Maryland, is within easy water haul of the large seaports of the northeast and is the nearest source of southern yellow pine piling. Consequently many thousand piles are cut each year. In 1940 about 74,000 were produced and practically all were pine except 1,500 oak piles and a few thousand swamp hardwood piles used in logging railroads. Two-thirds of the piles were handled by three

concerns, one at Portsmouth, one on the Eastern Shore in Accomac County, and one at West Point on the York River. The latter two shipped piles to the northeast.

The demand is for long piles, 70 percent of those produced were over 35 feet long and 20 percent were 60 feet and over. Stumpage prices vary with length, one operator paid farmers 3 to 4 cents per lineal foot for 40-foot piles, while another paid a large lumber company 10 cents per foot for piling under 70 feet with gradual increases up to 15 cents per foot for piling 90 feet long. On this basis the stumpage value of a tree containing a 90-foot pile is $13.50 compared to a saw-timber value of $5.00 with stumpage at $10.00. These long piles are, however, very rare. Woods employment to produce the 106,000 poles and piles amounted to 43,600 man-days.

Fence posts: The estimate of fence posts used in 1940 is based upon a sample obtained from 158 farms ranging in size from 10 to 2,000 acres, distributed throughout the Coastal Plain. Posts were cut on 54 percent of these farms and the actual number varied from 10 to 500. Distributing the total number of posts recorded over all sample farms resulted in an average of 48 posts per farm. White oak, red and white cedars, and black locust were the most commonly used species. The average post was 6 feet long and 4 to 5 inches in diameter.

On the basis of this sample the 38,000 farms in this survey unit used 1.8 million fence posts in 1940, with 1.6 million cut from sound trees. The total volume of wood going into posts was about 21,000 cords. Nearly 22,600 man-days of labor were expended in making posts, an average of less than one day per farm.

Summary of Employment

The primary forest products industries provided almost 4.5 million man-days of employment in 1940, equivalent to 17,000 man-years of 260 days each. Three-fourths of the employment was in commercial forest activities and provided a direct wage return, at 35 cents per hour, of about 9 million dollars. One-fourth of the labor was expended in the production of fuel wood and fence posts for domestic use, consequently the cash return was indirect. The lumber industry accounted for 40 percent of all commercial employment and the pulp and paper industry accounted for 35 percent.

Plant employment: In 1940 about 8,600 employees worked in the 655 primary forest products plants (table 16). Over one-half of these worked in sawmills but their average period of employment was only 110 days per year because so many of the mills were small part-time portables. Less than 2,000 people worked in the pulp and paper plants but they worked full-time and accumulated as many man-days of employment as all the sawmill employees. The veneer industry was also a significant source of employment providing practically full-time work for about 1,300 people. At 35 cents per hour the total wage income from all plant employment was 5.1 million dollars. This is an average of 600 dollars per employee, but

the average wage income ranged from 150 dollars in potato barrel plants to 975 dollars in the pulp and paper mills. Sawmill workers received about 400 dollars.

Table 16. - Plant employment in the primary forest industries, 1940

Commodity	Plants	Average days operated	Employment per unit of wood		Total employees	Total employment
	Number	Number	Man-hours	Unit	Number	Man-days1/
Lumber	567	110	2/ 11	MBF	4,636	666,900
Veneer & packages	7	256	119	MBF	1,295	344,600
Nail kegs	37	229	9	cord	366	83,800
Potato barrels	8	54	6	cord	65	3,600
Misc. cooperage	3	175	9	cord	36	6,700
Excelsior	19	233	6	cord	130	30,800
Pulp & Paper	4	348	13	cord	1,913	667,100
Handles	3	166	49	cord	39	7,800
Misc. mfg. prod.	7	161	42	cord	97	25,400
Total	655	124	--		8,577	1,836,700

1/ Man-days are of 8 hours.

2/ Only one-fourth of the lumber was kiln dried and planed at the producing mill, rough lumber provided 11 hours of employment per 1,000 board feet.

Table 17. - Woods employment in the primary forest industries, 1940

Commodity	Total employment	
	Man-days	Man-years1/
Lumber	569,400	2,190
Veneer	28,600	110
Nail kegs	37,300	140
Potato barrels	2,800	10
Misc. cooperage	5,200	20
Excelsior	58,300	220
Pulpwood	476,400	1,830
Handles	1,200	negl.
Misc. mfg. prod.	9,100	30
Fuel wood	1,271,500	4,890
Hewn crossties	48,100	190
Poles and piles	43,600	170
Fence posts	22,600	90
Total	2,571,800	9,890

1/260 man-days.

Woods employment: Cutting and hauling wood products for commercial use provided about 1.3 million man-days of employment or full-time work for 4,900 people. Cutting fuel wood and fence posts required an additional labor outlay of 1.3 million man-days distributed among most of the farmers of the unit. It is practically impossible to determine the actual number of people who obtained part of their cash income from woods work because of part-time operation, the contract system, and the practice of buying wood delivered at the mill, but the number is large because nearly 5,000 were logging for just the lumber industry. At least 2,000 people cut and hauled pulpwood, as one pulp company alone

reported having 15 agents each employing 15 to 40 workers. Over 80 percent of the commercial woods employment was in the lumber and pulp industries, but the less important industries provided enough woods work to keep 1,000 people occupied the year around.

FOREST INCREMENT AND COMMODITY DRAIN IN 1940

To be permanent, the forest products industries must have, among other things, an assured supply of raw material. A major factor influencing the supply is the relation between increment of the established forest and commodity drain. This relation is discussed in succeeding pages.

Forest Increment

Forest increment, as used in this report, is the gross volume of wood produced by growth of the sound-tree growing stock. The board-foot growing stock consists of all sound softwood trees 9.0 inches d.b.h. and larger and all sound hardwood trees 13.0 inches d.b.h. and larger. The growing stock expressed in cords and subic feet includes all sound trees at least 5.0 inches d.b.h. The small trees becoming 5.0 inches or more during the year are included in cordwood and cubic-foot increment and the young softwoods and hardwoods that become of saw-timber size are included in board-foot increment. Cull trees and the upper stems and limbs of hardwood saw timber are not considered growing stock material.

Net increment is the resultant of the volume gained through growth and the volume lost through mortality. Growth is composed of the volume recruited from small trees which grow into merchantable sizes during a given period and the volume added by the increase in diameter of merchantable trees.

Table 18. - Average net increment per acre in saw-timber stands by forest type and species group, 1940

Forest type	Soft-woods	Hard-woods	All species
	Bd.ft.	Bd.ft.	Bd.ft.
Loblolly pine	288	33	321
Shortleaf pine	168	29	197
Virginia pine	148	42	190
Cypress-cedars	152	120	272
Upland hardwood	31	135	166
Bottom-land hdwd.	40	211	251
All types	180	83	263

Mortality consists of the volume lost when sound trees are killed by fire, insects, disease, and wind and the volume lost through competition for light and water. This constant struggle for suitable growing space is a major cause of mortality in natural stands and a large part of the volume lost could be saved for utilization if the forest was managed for continuous crops of timber.

Net increment per acre: Species, sizes, and numbers of trees occur in a great variety of combinations on each acre of forest land and these variations cause

marked differences in the net increment per acre. Grouping the stands by forest type and saw-timber or cordwood condition reduces the irregularity and makes it possible to present the average net increment per acre for stands of the same general characteristics.

Saw-timber stands occupy 2.5 million acres - 63 percent of the forest land. The average net increment per acre on this land is 263 board feet per year, two-thirds softwoods and one-third hardwoods (table 18). The loblolly pine saw-timber stands produce the most net increment, 321 board feet, and this average applies to 1.3 million acres or one-half the saw-timber area. About four-fifths of this annual increase is loblolly pine and the rest is chiefly mixed hardwoods (table 41, Appendix).

Table 19. - Average net increment per acre in cordwood stands by forest type and species group, 1940

Forest type	Soft-woods	Hard-woods	All species	
	Cords	Cords	Cords	Cu.ft.
Loblolly pine	.53	.10	.64	36.0
Shortleaf pine	.65	.15	.80	48.0
Virginia pine	.61	.12	.73	33.2
Cypress-cedars	-	-	-	-
Upland hardwoods	.12	.52	.64	51.7
Bottom-land hdwd.	.04	.34	.38	29.3
All types	.37	.25	.62	39.3

Cordwood stands occupy 1.4 million acres - 37 percent of the forest area. The average net increment per acre on this land is 0.6 of a cord or 39 cubic feet (table 19). About two-fifths of the land is stocked with young loblolly pine which is growing at an average rate of 0.6 cords per acre per year. The average net increment of young, shortleaf pine stands is greater, 0.8 of a cord, but these stands occur on less than 100,000 acres. The cordwood stands of upland hardwoods rank after loblolly pine in extent and equal it in average net increment per acre.

Increment of the total stand: In 1940 the increment of the forest stand was 785.5 million board feet and the mortality loss was 37 million feet, leaving a net increment of 748.6 million feet (table 20). Eighty-six percent of this board-foot increase was in saw-timber stands and the other 14 percent was in young stands containing a few saw-timber trees. Two-thirds of the net increment was softwood, chiefly loblolly pine. Ten- and 12-inch trees yielded about 30 percent of this increment, 14-, 16-, and 18-inch trees yielded 50 percent, and larger trees produced the remaining 20 percent. One-half of the net increment of hardwood saw timber was in trees less than 20.0 inches in diameter.

The net increment of all sound trees 5.0 inches d.b.h. and larger amounted to 3.1 million cords after a deduction of 229,000 cords for mortality losses. In both the softwoods and hardwoods about 30 percent of the increment occurred in cordwood stands and 70 percent occurred in saw-timber stands. The 1.8 million cords of softwood increment (table 20)

Table 20. - Net increment by species group and class of material, 1940

Species group	Saw Timber	All sound trees 5.0 inches d.b.h. and larger	
	M bd.ft.	Cords	M cu.ft.
Softwoods:			
Yellow pine	472,900	1,597,600	111,750
Virginia pine	33,800	193,900	12,990
Other	6,200	11,400	920
Total	512,900	1,802,900	125,660
Hardwoods:			
Oaks	78,000	520,500	32,500
Gums	117,500	552,600	35,310
Other	40,200	232,100	15,150
Total	235,700	1,305,200	82,960
All species	748,600	3,108,100	208,620

was distributed by tree-diameter class in the following proportions: 6- and 8-inch trees, 18 percent; 10- and 12-inch trees, 27 percent; 14-, 16-, and 18-inch trees, 40 percent; and trees 20 inches and over, 15 percent. A larger part of the 1.3 million cords of hardwood increment was in the smaller stems as 31 percent was in 6- and 8-inch trees, 22 percent was in 10- and 12-inch trees, 32 percent was in 14-, 16-, and 18-inch trees, and 15 percent was in trees 20 inches and larger.

Commodity Drain

The commodity drain from the sound-tree growing stock is composed of both the material utilized and the sound usable material left in felled trees. It includes the wood cut and used within the unit and the wood shipped outside the unit, but excludes the wood brought in from the Piedmont of Virginia and from North Carolina. The drain on the sawlog portion of the trees, including both the utilized and wasted portions, is expressed in board feet, whereas the volumes given in cords and cubic feet include drain on saw timber, upper stems of sawlog-size softwoods, and small trees ranging from 5.0 inches d.b.h. to saw-timber size. The drain upon hardwood tops is not included.

Drain on saw-timber trees: In 1940 the commodity drain upon the saw-timber growing stock amounted to 501 million board feet of softwoods and 105 million feet of hardwoods, a total of 606 million board feet (table 21). Sixty-six percent of the saw-timber drain was caused by the lumber industry and 13 percent by the pulp and paper industry. Fuel wood was the next most important cause of saw-timber drain, accounting for 9 percent of the total.

Seventy-four percent of the drain was cut from loblolly and shortleaf pines, 6 percent was cut from Virginia pine and only 2 percent from cypress and white-cedar (table 42, Appendix). Hardwoods provided 18 percent of the saw-timber drain, about equally divided between the oaks and gums which include yellowpoplar.

Two-thirds of the softwood drain of saw timber was cut from trees 14 inches d.b.h. and larger and about one-half of the hardwood was cut from trees 20 inches and larger. A more detailed presentation of

commodity drain by diameter class is given in table 43, Appendix.

Table 21. - Commodity drain from the sound-tree growing stock, 1940 1/

Commodity	Saw timber		All sound trees	
	Soft-woods	Hard-woods	Soft-woods	Hard-woods
	M bd.ft.	M bd.ft.	Cords	Cords
Lumber	340,400	60,400	892,100	164,100
Veneer	800	15,700	2,000	40,100
Nail kegs	19,900	300	75,000	1,500
Potato barrels	1,100	- -	4,500	- -
Excelsoir	6,900	- -	38,900	- -
Pulpwood	75,400	900	341,800	7,300
Misc.mfg.prod.	2,100	700	8,600	2,300
Fuel wood	41,000	12,400	198,800	221,900
Hewn crossties	200	12,100	1,000	48,300
Poles & piles	12,500	1,000	35,600	2,800
Fence posts	1,000	1,100	6,500	12,200
All products	501,300	104,600	1,604,800	500,500

1/ In 1941 the estimated saw-timber drain was 707 million board feet.

Industries and domestic consumers within the unit used 592.4 million board feet of the commodity drain and 13.5 million feet were taken out of the unit. Sawmills in the Piedmont of Virginia drew 4.7 million feet from the Coastal Plain and pulp mills in North Carolina, Pennsylvania, and western Virginia obtained 7.2 million feet of saw-timber trees and 7,400 cords of smaller trees. About 1.5 million board feet of sawlogs and veneer bolts were shipped to Delaware and small quantities of stave bolts were taken to cooperage mills in Piedmont Virginia. Sawmills, veneer mills, pulp mills, stave mills, and excelsoir plants in this unit obtained about 99.4 million board feet of timber from North Carolina and Piedmont Virginia, however, so the total wood requirement of local mills and consumers, without any export to other areas, was 691.8 million board feet.

Drain on entire growing stock: Commodity drain upon the total sound-tree growing stock 5.0 inches d.b.h. and larger, including saw timber, was 2.1 million cords; 1.6 million cords of softwoods and 500,000 of hardwoods. Fifty percent was caused by the saw-timber drain of the lumber industry, 20 percent by fuel wood cutting of saw-timber and cordwood trees, and 17 percent by the pulp and paper industry which used about one-fourth cordwood and three-fourths saw-timber trees. None of the other wood products industries caused over 4 percent of the total drain. Two-thirds of all the drain was yellow pine, chiefly loblolly (table 42, Appendix). Forty-seven percent of the total drain was obtained from trees less than 13.0 inches d.b.h., 32 percent was cut from 14- to 18-inch trees, and 21 percent was cut from trees 20.0 inches d.b.h. and larger. These proportions approximate the distribution of drain in both the softwoods and hardwoods.

About 52,000 cords of the commodity drain were shipped to sawmills, veneer plants, pulp mills, and cooperage plants outside the Coastal Plain; the remainder, slightly over 2 million cords, were used locally. Nearly 284,000 cords of wood were imported from North Carolina and Piedmont Virginia chiefly for use in sawmills, veneer plants, and pulp mills. The wood brought in exceeded the wood sent out by 232,000 cords but a large part of this importation is a result of lumber and pulp companies at Suffolk and Norfolk operating their forest lands in North Carolina, rather than a scarcity of wood. If all of the wood had been cut within the unit the total community drain would have been 2.3 million cords.

Comparison of Increment with Commodity Drain

The kind and quantity of forest growing stock determines, to a large extent, the annual yield of timber that will be available for utilization under sustained-yield forest practice. If the annual yield, or net increment, exceeds the commodity drain, the growing stock will be increased by this surplus and subsequent yields will be greater. On the other hand, when drain exceeds net increment the forest growing stock is reduced and if this happens every year the forest will eventually cease to be an important resource. An over-all comparison of net increment with commodity drain reveals the status of the total forest stand but a more detailed comparison by species group and diameter class provides a better basis for measuring the volume changes in the species and sizes most in demand.

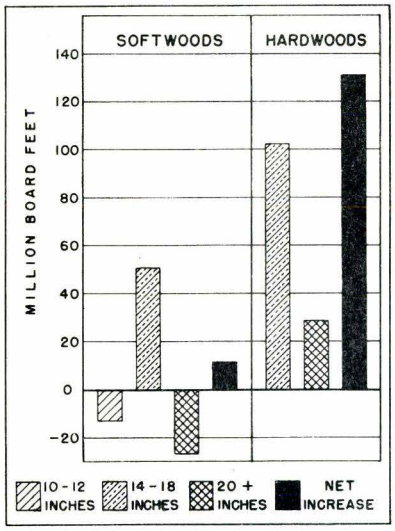

FIGURE 18-BOARD-FOOT CHANGE IN GROWING STOCK BY TREE-DIAMETER CLASS, 1940.

The following discussion applies to the situation existing in 1940. Since then the war has caused a marked increase in the use of forest products and the annual drain upon the saw-timber stand has increased by an estimated 15 to 20 percent. In some species and diameters, it is probable that drain is now materially in excess of net increment.

Comparison in board feet: In 1940 the net increment of softwoods exceeded commodity drain by a very narrow margin and the growing stock increased by only one-tenth of one percent. Both the 10- and 12-inch and the 20-inch and larger diameter-class groups were overcut, by 12.4 and 26.2 million board feet respectively, and the only increase, 50.2 million feet, was in the 14- to 18-inch trees (fig. 18).

By species group the relation was slightly different as the cypress and cedar lost volume in all diameter classes, reducing the growing stock about 2 percent. Virginia pine was overcut by 5.3 million board feet in the 10- and 12-inch classes, resulting in a one percent reduction in growing stock, in spite of an increase in the volume of larger trees.

The yellow pines, with a 49.2 million-foot increase in the 14- to 18-inch classes to counteract the volume losses in the other diameters, increased in volume by 21.6 million board feet, a gain of less than three-tenths of one percent.

In the hardwoods the net board-foot increment was more than twice the commodity drain, the net increase in growing stock amounting to 131.1 million board feet, 3.4 percent. All three species groups - oaks, gums, and other hardwoods - increased in volume in both the 14 to 18 and 20-inch and larger diameter groups, but only one-fifth of the volume increase was in the larger trees.

Comparison in cords: The net increment of the entire sound-tree growing stock 5.0 inches d.b.h. and larger exceeded the commodity drain by one million cords (table 49, Appendix), increasing the softwood growing stock by 198,100 cords and the hardwood growing stock by 804,700 cords. All species groups increased in volume except cypress and cedar which suffered a total loss of 24,600 cords.

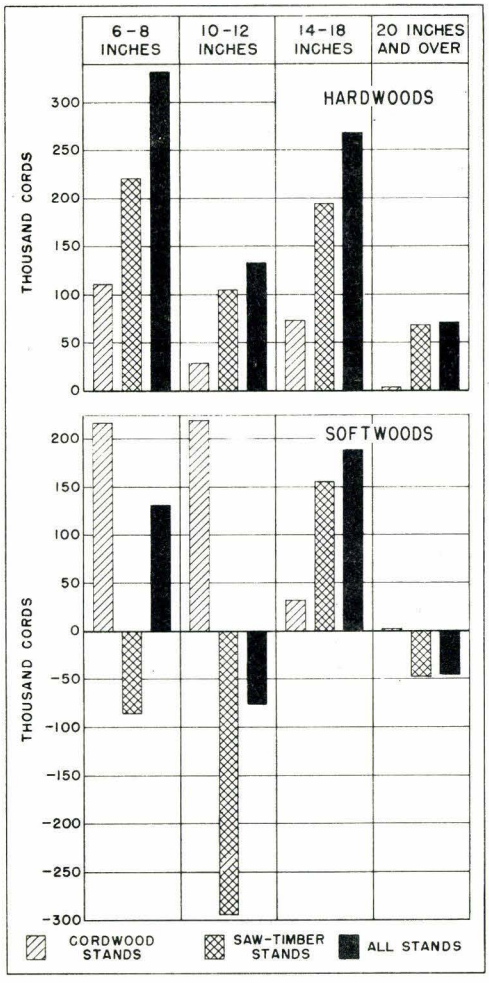

FIGURE 19- CHANGE IN CORDWOOD GROWING STOCK BY TREE-DIAMETER CLASS AND FOREST CONDITION, 1940.

Although the over-all net volume of softwood growing stock increased during 1940, there were rather serious decreases in certain components of the stand. This is illustrated in figure 19, which shows the net change in growing stock by diameter classes for cordwood and saw-timber stands and the total stand. For instance, the total volume of 6- and 8-inch trees increased but trees of these diameters in saw-timber stands were reduced in volume. Likewise the 10- and 12-inch trees in saw-timber stands were reduced in volume by nearly 300,000 cords and the volume increase of similiar trees in cordwood stands was insufficient to compensate for the loss. A comparable situation exists in the 20-inch and larger diameter class.

The striking deficit in the 10- and 12-inch diameter class is caused by two factors. Over one-half of the softwood drain for nail kegs, potato barrels, excelsior, pulpwood, and fuel wood was cut from 10- and 12-inch trees and consequently 36 percent of the total softwood drain came from this single diameter class. In addition, an unusually large volume of

10- and 12-inch trees moved into the 14- to 18-inch diameter class as a result of growth during the year, accounting for 90 percent of the total increment in this larger class.

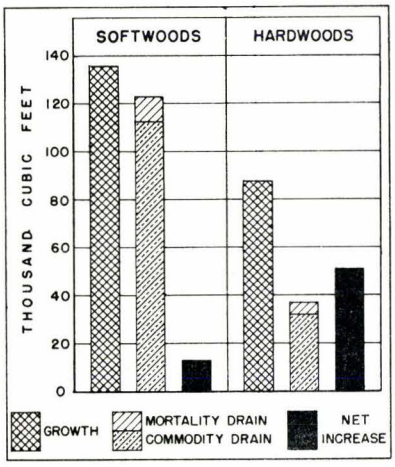

FIGURE 20-COMPARISON OF INCREMENT WITH MORTALITY AND COMMODITY DRAIN, 1940.

Comparison in cubic feet: The effect of increment and mortality and commodity drain upon the softwood and hardwood growing stock is summarized in cubic feet in figure 20. In spite of volume losses in certain diameter classes, the softwood growing stock increased by 13 million cubic feet. The hardwood growing stock increased in all species groups and diameter classes for a total gain of 51 million cubic feet.

FUTURE TIMBER SUPPLIES

The foregoing analysis of increment and drain has shown that there was a net increase in board-foot volume of both the softwood and hardwood saw timber growing stock in 1940 and also a net increase in the total volume of all sound trees 5.0 inches d.b.h. and larger. Within certain species groups and diameter classes there were decreases in growing stock volumes but the over-all picture appears favorable. This infers that the forest products industries and other wood consumers of the Coastal Plain can continue to use as much wood as in 1940 without reducing the growing stock.

Prediction of future timber supplies is hazardous for such a large area because the following factors are subject to considerable change over a period of years: commodity drain, growth rates of individual trees and stands, mortality, cutting practices, and stand composition. Nevertheless the forest industries, public conservation agencies, and the general public are so vitally interested in the future supply of timber that a prediction, based upon reasonable assumptions, is in order.

Hardwoods

The situation in respect to the supply of hardwood timber is obvious. All three species groups; oaks, gums and yellowpoplar, and other hardwoods, are increasing in all diameter classes at a very rapid rate in both the sawtimber and cordwood sizes. The chief danger is that they may increase too much at the expense of the pines. The hardwood cut can be nearly doubled without reducing the present growing stock if the cut is distributed to all species admitting, however, that special woods such as ship timber oak, aircraft yellowpoplar and sweetgum, and select ash may be hard to find at present and even harder to find in the future.

Softwoods

The most critical softwood species group is the "other softwoods" - cypress and cedar. Total drain is three times the net increment in these species and the growing stock is being reduced in all diameter classes. At present rates of cutting practically all of the white-cedar saw timber will be cut before 1950 and there is not enough young second growth to assure a continuous supply of saw timber in the future. The cypress will last longer but commercially it is a disappearing species in Virginia.

Virginia pine is used chiefly for pulpwood, lumber and fuel wood. It is typically a rather small, very limby tree, with the branches often extending completely to the ground. Because it is so small and knotty it is an inferior species for lumber and is less desirable than loblolly and shortleaf pine for pulpwood. Mechanical difficulties in cutting and splitting limit its use for fuel wood if other species of pine are available. In view of these factors and the favorable balance of increment over drain, it appears that Virginia pine will continue to increase, unless drain materially exceeds the 1940 level.

Most significant, as the forest industries are now organized, is the future supply of yellow pine - loblolly and shortleaf pine. In 1940 two-thirds of the entire quantity of wood consumed was cut from this species group, which is 90 percent loblolly pine. As a result the growing stock was reduced in the 10- and 12-inch and 20-inches and larger diameter classes, but increased in other sizes to create a net increase of 22 million board feet of saw timber and 206,000 cords of all material in trees 5 inches d.b.h. and larger. Considering this small increase in growing stock, what are the prospects for realizing the following objectives: (1) maintaining the 1940 commodity drain, (2) increasing the drain by 25 percent, or (3) increasing the drain by 35 percent between 1940 and 1950 to allow for war and post war requirements, and then dropping back to the 1940 level for the remaining 20 years?

The three sections, A, B, and C, of figure 21 indicate the possible development of the stand over a 30 year period with the commodity drain at the proposed three levels. In projecting the stand forward the following assumptions were made: (1) the volume recruiting into the 6- and 8-inch class will be maintained at the 1940 level because one-third of the yellow pine type area is now stocked with young growth and future cutting practices should at least provide for continued restocking, (2) the ratio of inventory to the volume recruiting out of any diameter class is constant at the 1940 level, and (3) the growth of the trees in any given diameter class is at the 1940 level.

Figure 21-A is based upon the assumption that commodity drain will equal 1940 each year for 30 years and that it will be distributed among diameter classes in the same way. At this rate of cutting the growing stock increases from 2 billion cubic feet in 1940 to 3.5 billion feet in 1970, a net gain of 73 percent. The 20-inch and larger class will decrease until about 1945 but then the influx of volume from the 14-, 16-, and 18-inch trees will begin to have an effect and the 20-inch class will gradually increase. The volume distribution by diameter class

of the 1970 stand is a decided improvement over the 1940 stand and indicates that cutting at the 1940 level will result in a gradual but appreciable building up of the yellow pine growing stock. In fact the stand appears to improve so rapidly that the practicality of increasing the cut is worth investigating.

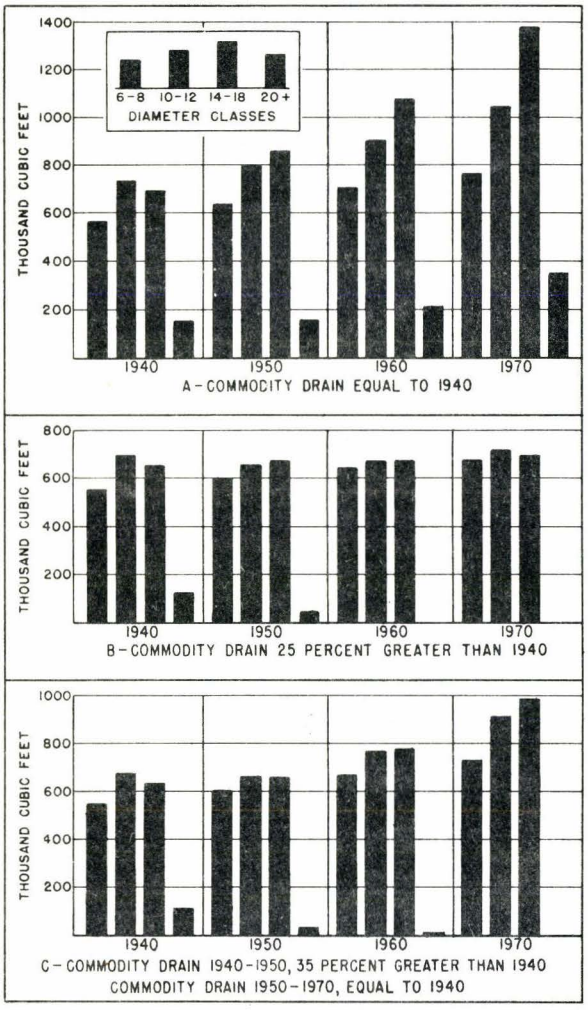

FIGURE 21- POSSIBLE TRENDS IN THE VOLUME AND DISTRIBUTION OF YELLOW PINE GROWING STOCK AT THREE LEVELS OF COMMODITY DRAIN.

In figure 21-B the commodity drain has been set at 25 percent above 1940. Cutting practices are considered to remain the same so that the proportionate distribution of the drain by diameter classes remains unchanged. Obviously the growing stock is at present unable to support a 25 percent increase in cut and still build up at a satisfactory rate. Actually the total volume of growing stock remains practically constant, but trees 20 inches and larger disappear from the stand. An emergency demand for lumber and pulp or an acute need for forest employment might be justification for cutting at this rate for a short period, but in the long run the people and forest industries of the Coastal Plain will derive greater benefit from the forest resource by making only a small increase in the use of yellow pine.

With the outbreak of war in 1941 the demands upon the forests of coastal Virginia have greatly increased. The yellow pines are the leading species used for construction of army camps, air field facilities, defense houses and army depots. Great quantities of yellow pine piles and timbers are used at shipyards, and vast numbers of pine crossties are required to maintain the railroads of a nation at war. To win the war it is essential that we produce all the lumber and timber products that are needed and, if conservative cutting methods are practiced, the yellow pine forests of coastal Virginia can contribute their full share and still be productive in the post-war period.

In figure 21-C the commodity drain has been set at 35 percent above the 1940 level for the 1940 to 1950 period and has then been decreased to the 1940 level for the remaining 20 years. The excessive demands of war and post-war construction are thus amply allowed for, as it is doubtful whether the drain upon the yellow pine will be 35 percent higher than 1940 even at the height of the war effort. Under these conditions the growing stock can be expected to increase from 2 billion cubic feet in 1940 to 2.6 billion feet in 1970 although the heavy cutting in the 1940-1950 year period will practically eliminate the trees 20-inches and larger from the stand.

From a practical standpoint there appear to be only two choices if the forest is to continue to be productive. The attainment of stands A or C, illustrated in figure 21, depends upon the cooperation of the wood using industries and other landowners in promoting and practicing timber harvesting methods that will maintain a productive growing stock of pine upon the forest land. For instance, cutting all of the pine from mixed pine-hardwood stands reduces the pine acreage. Failure to leave enough seed trees for adequate restocking prevents the constant replenishment of the 6- and 8-inch diameter classes so necessary for a continuous supply of pine. Also, cutting the young small-sized timber lowers the productivity of the stand because more trees must be cut to obtain a given volume and these are the trees which are growing most rapidly. Fire protection is essential and in this the landowners should cooperate actively with the Virginia Forest Service. If these, and other constructive measures are followed, it is reasonable to expect the over-all supply of yellow pine to increase although the probability remains that there will be local shortages due to concentrated over-cutting, unavailable ownerships, or a predominance of young unmerchantable timber.

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50 - Comparison in cubic feet between increment and drain of all sound material 5.0 inches d.b.h. and larger, 1940.

Table 22.- Species composition of the forest types expressed in percent of net cubic volume (inside bark), 1940

Species	Loblolly pine	Virginia pine	Shortleaf pine	Cypress-cedar	Upland hardwoods	Bottomland hardwoods	All types
	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Loblolly pine	73.0	19.9	17.4	2.9	7.2	6.2	43.0
Shortleaf pine	3.3	2.8	52.7	-	1.2	0.1	4.0
Virginia pine	1.6	41.9	1.2	-	1.5	0.1	3.6
Pond pine	0.1	-	-	-	-	negl.	negl.
Cypress	0.1	-	-	37.9	negl.	3.2	1.2
White-cedar	negl.	-	-	15.9	negl.	0.2	0.3
Redcedar	0.1	0.1	0.8	0.2	0.1	negl.	0.1
Red oaks - poor	3.6	9.9	7.4	0.5	15.4	4.0	6.4
Red oaks - good	0.6	0.4	0.6	-	3.2	1.9	1.3
White oaks - poor	0.6	1.2	2.5	0.2	2.4	0.4	1.0
White oaks - good	3.5	7.5	5.6	0.1	18.0	3.5	6.5
Sweetgum	6.0	4.1	5.3	5.2	12.2	20.1	9.4
Tupelos	1.8	1.3	0.8	26.6	3.0	27.4	6.8
Yellowpoplar	2.5	5.1	2.4	1.5	13.1	6.2	5.3
Red maple	0.9	0.4	0.5	3.5	2.5	9.6	2.7
Beech	0.5	1.4	0.2	0.2	8.2	0.8	2.0
Hickory	0.6	2.3	1.1	0.1	7.2	1.0	2.1
Ash	negl.	negl.	0.1	1.7	0.5	5.6	1.1
Dogwood	0.4	0.9	0.4	0.1	1.5	0.8	0.7
Scrub hardwoods	0.3	0.4	0.4	0.5	0.8	1.2	0.5
Other hardwoods	0.5	0.4	0.6	2.9	2.0	7.7	2.0
All species	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 23. - Forest area classified by forest condition and forest type, 1940

Forest condition	Loblolly pine1/	Virginia pine	Shortleaf pine	Cypress-cedar	Upland hardwoods	Bottomland hardwoods	All types	
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Percent
Saw-timber stands:								
Old growth:								
Uncut	10,500	-	800	4,000	18,500	29,000	62,800	1.6
Partly cut	12,900	-	-	2,400	20,100	13,700	49,100	1.3
Total	23,400	-	800	6,400	38,600	42,700	111,900	2.9
Second growth:								
Uncut	906,100	122,300	69,100	16,200	307,500	282,500	1,703,700	43.4
Partly cut	350,100	49,900	24,200	4,800	175,400	57,100	661,500	16.9
Total	1,256,200	172,200	93,300	21,000	482,900	339,600	2,365,200	60.3
All saw timber	1,279,600	172,200	94,100	27,400	521,500	382,300	2,477,100	63.2
Cordwood stands:								
Second growth	548,800	135,200	65,200	5,600	367,000	154,500	1,276,300	32.6
Reproduction	91,000	23,400	4,800	3,200	8,800	34,600	165,800	4.2
All cordwood	639,800	158,600	70,000	8,800	375,800	189,100	1,442,100	36.8
All conditions	1,919,400	330,800	164,100	36,200	897,300	571,400	3,919,200	100.0
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	
	49.0	8.4	4.2	0.9	22.9	14.6	100.0	-

1/Includes 12,100 acres of pond pine type.

Table 24. - Distribution of forest-type area by age class, 1940

Age class	Loblolly pine	Virginia pine	Shortleaf pine	Cypress-cedar	Upland hardwoods	Bottomland hardwoods	All types
Years	Acres	Acres	Acres	Acres	Acres	Acres	Acres
10	263,000	66,500	9,400	16,000	56,600	117,700	529,200
20	351,300	63,800	17,100	-	53,000	31,400	516,600
30	412,700	63,900	44,100	1,400	101,400	43,400	666,900
40	370,400	52,900	32,300	-	160,600	56,600	672,800
50	239,900	40,000	27,300	2,900	154,300	49,700	514,100
60	147,800	20,200	18,700	1,400	148,100	52,600	388,800
70	63,300	13,600	7,700	2,900	97,800	62,900	248,200
80	30,700	6,300	5,900	-	52,900	41,700	137,500
90	19,200	1,000	800	-	22,400	23,400	66,800
100 +	21,100	2,600	800	11,600	50,200	92,000	178,300
Total	1,919,400	330,800	164,100	36,200	897,300	571,400	3,919,200

Table 25. - Net board-foot volume by species and three log rules, 1940

Species	International ¼-inch	Scribner	Doyle
	M bd. ft.	M bd. ft.	M bd. ft.
Softwoods:			
Loblolly pine	6,835,900	5,834,800	3,941,900
Shortleaf pine	450,000	371,900	229,000
Virginia pine	352,500	292,600	181,200
Pond pine	3,500	2,900	1,700
Cypress-cedars	277,300	242,800	178,400
All softwoods	7,919,200	6,745,000	4,532,200
Hardwoods:			
Red oaks - poor	446,300	406,300	328,400
Red oaks - good	152,200	140,500	121,600
White oaks - poor	51,100	46,400	37,300
White oaks - good	363,000	329,600	263,900
Sweetgum	777,900	702,500	544,000
Tupelos	648,200	590,600	479,000
Yellowpoplar	529,700	480,800	383,000
Red maple	221,900	201,000	158,200
Beech	223,600	204,100	166,600
Hickory	145,200	131,400	103,000
Ash	91,800	83,100	65,000
Other hardwoods	177,900	161,600	128,800
All hardwoods	3,828,800	3,477,900	2,778,800
All species	11,748,000	10,222,900	7,311,000

Table 26. - Net board-foot volume, International $\frac{1}{4}$-inch rule, by species and forest conditions, 1940

Species	Saw-timber stands			Cordwood stands1/	All conditions	
	Old growth	Second growth				
		Uncut	Partly cut			
	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.	Percent
Softwoods:						
Loblolly pine2/	371,500	5,063,800	1,262,900	141,200	6,839,400	58.2
Shortleaf pine	28,700	321,600	83,100	16,600	450,000	3.8
Virginia pine	2,000	267,700	66,500	16,300	352,500	3.0
Cypress	60,000	118,700	22,400	800	201,900	1.7
White-cedar	43,400	20,300	300	900	64,900	0.6
Redcedar	-	8,200	700	1,600	10,500	0.1
All softwoods	505,600	5,800,300	1,435,900	177,400	7,919,200	67.4
Hardwoods:						
Red oaks - poor	36,300	279,400	117,600	13,000	446,300	3.8
Red oaks - good	32,700	84,100	32,600	2,800	152,200	1.3
White oaks - poor	8,100	31,900	10,200	900	51,100	0.4
White oaks - good	28,700	238,500	80,100	15,700	363,000	3.1
Sweetgum	80,100	514,900	161,100	21,800	777,900	6.6
Tupelos	273,800	308,200	57,800	8,400	648,200	5.5
Yellowpoplar	71,200	354,800	93,600	10,100	529,700	4.5
Red maple	27,500	141,400	44,800	8,200	221,900	1.9
Beech	60,400	111,400	46,400	5,400	223,600	1.9
Hickory	22,500	71,400	44,900	6,400	145,200	1.3
Ash	19,000	69,800	3,000	-	91,800	0.8
Other hardwoods	34,600	113,600	26,800	2,900	177,900	1.5
All hardwoods	694,900	2,319,400	718,900	95,600	3,828,800	32.6
All species	1,200,500	8,119,700	2,154,800	273,000	11,748,000	100.0
	Percent	Percent	Percent	Percent	Percent	
	10.2	69.1	18.4	2.3	100.0	-

1/Includes reproduction condition.
2/Includes 3.5 million board feet of pond pine.

Table 27. - Net board-foot volume, International $\frac{1}{4}$-inch rule, by species and tree-diameter class (inches), 1940

Species	10 and 12	14, 16, and 18	20, 22, and 24	26 and over	All diameters
	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.
Softwoods:					
Loblolly pine	2,749,900	3,126,900	764,400	198,200	6,839,400
Shortleaf pine	277,700	150,400	14,900	7,000	450,000
Virginia pine	203,600	137,800	11,100	-	352,500
Cypress	55,900	88,300	42,800	14,900	201,900
White-cedar	7,100	29,500	26,200	2,100	64,900
Redcedar	6,400	3,300	800	-	10,500
All softwoods	3,300,600	3,536,200	860,200	222,200	7,919,200
Hardwoods:					
Red oaks - poor	-	244,300	122,200	79,800	446,300
Red oaks - good	-	48,600	53,400	50,200	152,200
White oaks - poor	-	29,900	10,700	10,500	51,100
White oaks - good	-	222,100	74,200	66,700	363,000
Sweetgum	-	544,600	186,100	47,200	777,900
Tupelos	-	366,000	174,500	107,700	648,200
Yellowpoplar	-	317,600	141,500	70,600	529,700
Red maple	-	145,300	63,600	13,000	221,900
Beech	-	116,700	78,500	28,400	223,600
Hickory	-	92,300	43,300	9,600	145,200
Ash	-	63,100	18,600	10,100	91,800
Other hardwoods	-	109,800	45,800	22,300	177,900
All hardwoods	-	2,300,300	1,012,400	516,100	3,828,800
All species	3,300,600	5,836,500	1,872,600	738,300	11,748,000

Table 28. - Average board-foot volume per acre, International ¼-inch rule, by forest type and forest condition, 1940

Forest type	Saw-timber stands				Cordwood stands	Weighted average of all conditions
	Old growth	Second growth		Weighted average		
		Uncut	Partly cut			
	Bd. ft.	Bd. ft.	Bd. ft.	Bd. ft.	Bd. ft.	Bd. ft.
Loblolly pine	14,910	5,910	3,920	5,530	180	3,740
Virginia pine	-	3,150	2,300	2,900	130	1,570
Shortleaf pine	19,250	3,410	2,800	3,380	230	2,040
Cypress-whitecedar	16,360	6,020	5,460	8,340	-	6,310
Upland hardwoods	6,780	2,920	2,120	2,940	240	1,810
Bottomland hdwds	11,000	4,080	3,500	4,760	180	3,250
Average all types	10,730	4,770	3,260	4,630	190	3,000

Table 29. - Net cordwood volume of all sound material, including bark, by species and quality class, 1940

Species	Saw-timber trees		Cordwood trees	Cull trees	Total	
	Sawlogs	Upper stems				
	Cords	Cords	Cords	Cords	Cords	Percent
Softwoods:						
Loblolly pine	16,758,400	3,524,400	7,001,100	638,700	27,922,600	37.6
Shortleaf pine	1,171,800	282,600	1,107,700	46,800	2,608,900	3.5
Virginia pine	910,900	321,600	1,107,200	219,000	2,558,700	3.4
Cypress-cedars	656,700	160,400	153,000	87,400	1,057,500	1.4
All softwoods	19,497,800	4,289,000	9,369,000	991,900	34,147,700	45.9
Hardwoods:						
Red oaks	1,615,900	919,500	2,834,300	612,900	5,982,600	8.1
White oaks	1,160,800	637,000	3,541,600	743,300	6,082,700	8.2
Sweetgum	1,879,800	1,122,700	3,527,700	993,900	7,524,100	10.1
Tupelos	1,834,700	1,025,500	1,803,600	1,708,200	6,372,000	8.6
Yellowpoplar	1,330,100	749,500	1,636,600	290,200	4,006,400	5.4
Red maple	601,600	349,600	835,500	1,254,100	3,040,800	4.1
Beech	587,500	358,200	401,800	395,800	1,743,300	2.4
Hickory	429,200	239,200	772,600	132,100	1,573,100	2.1
Ash	232,800	129,800	424,700	289,500	1,076,800	1.4
Other hardwoods	453,400	270,400	1,108,800	945,100	2,777,700	3.7
All hardwoods	10,125,800	5,801,400	16,887,200	7,365,100	40,179,500	54.1
All species	29,623,600	10,090,400	26,256,200	8,357,000	74,327,200	100.0

Table 30. - Net cordwood volume of sound trees by species and diameter class, 1940

Species	Tree-diameter class (inches)				Total	
	6 - 8	10 - 12	14, 16, and over	20 and over		
	Cords	Cords	Cords	Cords	Cords	Percent
Softwoods:						
Loblolly pine	7,001,100	9,796,300	8,303,200	2,183,300	27,283,900	45.4
Shortleaf pine	1,107,700	1,006,300	399,500	48,600	2,562,100	4.3
Virginia pine	1,107,200	802,500	401,300	28,700	2,339,700	3.9
Cypress-cedars	153,000	193,000	291,700	185,700	823,400	1.4
All softwoods	9,369,000	11,798,100	9,395,700	2,446,300	33,009,100	55.0
Hardwoods:						
Red oaks	1,306,300	1,528,000	871,600	744,300	4,450,200	7.4
White oaks	1,582,900	1,958,700	759,300	401,500	4,702,400	7.8
Sweetgum	1,578,600	1,949,100	1,359,000	520,800	5,407,500	9.0
Tupelos	652,900	1,150,700	1,101,200	733,500	3,638,300	6.1
Yellowpoplar	710,200	926,400	841,900	488,200	2,966,700	4.9
Red maple	386,500	449,000	410,300	191,300	1,437,100	2.4
Beech	136,100	265,700	328,900	258,600	989,300	1.7
Hickory	339,300	433,300	288,200	141,000	1,201,800	2.0
Ash	215,500	209,200	166,100	66,700	657,500	1.1
Other hardwoods	567,500	501,900	336,000	156,800	1,562,200	2.6
All hardwoods	7,475,800	9,372,000	6,462,500	3,702,700	27,013,000	45.0
All species	16,844,800	21,170,100	15,858,200	6,149,000	60,022,100	100.0

Table 31. - Average cordwood volume per acre by forest type and forest condition, 1940

Forest type	Saw-timber stands				Cordwood stands	Weighted average of all conditions
	Old growth	Second growth		Weighted average		
		Uncut	Partly cut			
	Cords	Cords	Cords	Cords	Cords	Cords
Loblolly pine	37.71	25.43	18.10	23.65	4.72	17.34
Virginia pine	-	17.92	14.44	16.91	4.37	10.90
Shortleaf pine	46.75	19.25	16.40	18.75	6.30	13.44
Cypress-whitecedar	53.28	26.64	22.94	32.21	.07	24.40
Upland hardwoods	21.27	16.75	13.73	16.07	7.02	12.28
Bottomland hardwoods	35.81	20.72	15.95	21.69	3.89	15.80
Average all types	32.27	22.30	16.45	21.19	5.22	15.31

Table 32. - Net cubic-foot volume of all sound wood, without bark, by species and quality class, 1940

Species	Saw-timber trees		Cordwood trees	Cull trees	All classes	
	Sawlogs	Upper stems				
	M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.	Percent
Softwoods:						
Loblolly pine	1,174,500	245,820	454,730	43,760	1,918,820	39.3
Shortleaf pine	81,080	19,400	71,890	3,140	175,510	3.6
Virginia pine	62,340	22,140	71,810	14,860	171,150	3.5
Cypress-cedars	50,980	9,900	11,060	6,910	78,850	1.6
All softwoods	1,368,910	297,260	609,490	68,670	2,344,330	48.0
Hardwoods:						
Red oaks	107,880	54,480	170,430	39,390	372,180	7.6
White oaks	76,830	37,750	212,460	47,760	374,800	7.7
Sweetgum	127,760	66,660	217,300	63,110	474,830	9.7
Tupelos	121,530	59,450	113,400	111,380	405,760	8.3
Yellowpoplar	86,560	42,770	100,250	18,860	248,440	5.1
Red maple	41,000	21,290	55,090	84,260	201,640	4.2
Beech	40,520	21,980	25,950	26,250	114,700	2.3
Hickory	28,230	14,080	47,740	8,310	98,360	2.0
Ash	15,140	7,410	25,960	18,350	66,860	1.4
Other hardwoods	31,150	16,470	70,800	60,920	179,340	3.7
All hardwoods	676,600	342,340	1,039,380	478,590	2,536,910	52.0
All species	2,045,510	639,600	1,648,870	547,260	4,881,240	100.0

Table 33. - Number of pine poles, by diameter and length, 1940

D.b.h. of trees (outside bark)	Pole length (feet)						All lengths	
	20	25	30	35	40	45 & over		
Inches	1,000 poles	1,000 poles	1,000 poles	1,000 poles	1,000 poles	1,000 poles	1,000 poles	Percent
7.0 - 8.9	4,700	1,460	410	100	-	-	6,670	31.2
9.0 - 10.9	2,640	1,970	1,300	730	230	20	6,890	32.3
11.0 - 12.9	1,360	1,210	980	710	430	170	4,860	22.8
13.0 - 14.9	240	370	440	420	340	230	2,040	9.5
15.0 - 16.9	-	100	130	160	170	180	740	3.5
17.0 - 18.9	-	-	20	30	40	70	160	0.7
All sizes	8,940	5,110	3,280	2,150	1,210	670	21,360	100.0
All sizes	Percent	Percent	Percent	Percent	Percent	Percent	Percent	
All sizes	41.8	23.9	15.4	10.1	5.7	3.1	100.0	-

Table 34. - Descriptive summary of sawmills by capacity class, 1940

Item	Rated capacity M bd. ft. in 8-hours				All mills
	1-9	10-19	20-39	40 +	
	Number	Number	Number	Number	Number
Sawmills:	506	49	9	3	567
Portable	386	21	-	-	407
Stationary	120	28	9	3	160
Power:					
Steam	242	38	8	3	291
Gasoline	205	3	-	-	208
Diesel	55	8	-	-	63
Electric	4	-	1	-	5
Feed:					
Belt or friction	502	30	1	-	533
Auxiliary steam	4	16	1	-	21
Shotgun	-	3	7	3	13
Equipment:					
Circular saw	506	43	1	-	550
Band saw	-	6	8	3	17
Resaw	5	5	2	2	14
Edger	179	47	9	3	238
Trimmer	38	16	8	3	65
Planer	63	14	4	2	83
Dry kiln	3	7	6	3	19

Table 35. - Methods of logging at sawmills of various capacity classes, 1940

Item	Rated capacity M bd. ft. in 8-hours			
	1-9	10-19	20-39	40 +
	Percent	Percent	Percent	Percent
Bunching:				
Animals	98	92	91	67
Tractors	2	2	29	67
Skidders	negl.	10	-	67
Short haul:				
High wheels				
Animals	88	100	50	-
Tractors	5	-	50	-
Other	7	-	-	-
Long haul:				
Trucks	96	100	100	100
Railroad	-	11	-	67
Other	4	-	-	33
	Miles	Miles	Miles	Miles
Avg. length short haul	1/3	2/5	1/2	-
Avg. length long haul	6	10	14	48

Table 36. - Lumber production by species group and capacity class of sawmill, 1940

Species group	Rated capacity M bd. ft. in 8-hours				All mills	
	1-9	10-19	20-39	40 +		
	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.	Percent
Softwoods:						
Yellow pine[1/]	221,600	72,800	41,700	47,200	383,300	77.9
Virginia pine	19,000	1,000	100	-	20,100	4.1
Other	600	2,800	700	10,800	14,900	3.0
All softwoods	241,200	76,600	42,500	58,000	418,300	85.0
Hardwoods:						
Oaks	20,100	4,500	1,300	200	26,100	5.3
Gums[2/]	13,400	5,800	3,000	22,600	44,800	9.1
Other	300	100	100	2,500	3,000	0.6
All hardwoods	33,800	10,400	4,400	25,300	73,900	15.0
All species	275,000	87,000	46,900	83,300	492,200	100.0

1/Loblolly and shortleaf pine.
2/Black and water tupelo, sweetgum, and yellowpoplar.

Table 37. - Lumber production by species group and diameter class, 1940

Species group	Diameter - class (inches)				All diameters	
	6-8	10-12	14-18	20 +		
	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.	Percent
Softwoods:						
Yellow pine[1/]	2,300	47,900	171,300	161,800	383,300	77.9
Virginia pine	500	10,400	9,200	-	20,100	4.1
Other	300	2,000	5,200	7,400	14,900	3.0
All softwoods	3,100	60,300	185,700	169,200	418,300	85.0
Hardwoods:						
Oaks	-	800	10,500	14,800	26,100	5.3
Gums[2/]	-	1,000	13,800	30,000	44,800	9.1
Other	-	100	1,000	1,900	3,000	0.6
All hardwoods	-	1,900	25,300	46,700	73,900	15.0
All species	3,100	62,200	211,000	215,900	492,200	100.0

1/Loblolly and shortleaf pine.
2/Black and water tupelo, sweetgum, and yellowpoplar.

Table 38. - Average net increment per acre by forest type and species group, 1940

SAW-TIMBER STANDS

Forest type	Yellow pines	Virginia pine	Other softwoods	Oaks	Gums-yellow-poplar	Other hardwoods	All species	
	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Cu.ft.
Loblolly pine	284	4	negl.	12	17	4	321	70.6
Shortleaf pine	166	2	negl.	16	11	2	197	54.9
Virginia pine	54	94	negl.	26	12	4	190	49.2
Cypress-cedars	20	-	132	2	98	20	272	100.5
Upland hardwood	25	6	negl.	58	49	28	166	45.7
Bottomland hardwood	33	1	6	29	139	43	251	63.1
All types	167	10	3	25	43	15	263	62.5

CORDWOOD STANDS (under-sawlog-size conditions)

	Cords	Cords	Cords	Cords	Cords	Cords	Cords	Cu.ft.
Loblolly pine	.52	.02	-	.04	.05	.01	.64	36.0
Shortleaf pine	.62	.03	-	.09	.05	.01	.80	48.0
Virginia pine	.13	.48	-	.05	.05	.02	.73	33.2
Cypress-cedars	-	-	-	-	-	-	-	-
Upland hardwood	.10	.02	-	.27	.16	.09	.64	51.7
Bottomland hardwood	.04	negl.	-	.04	.18	.12	.38	29.3
All types	.30	.07	-	.10	.10	.05	.62	39.3

Table 39. - Net increment in board feet, Int. $\frac{1}{4}$-inch rule, by species group and tree-diameter class, 1940

Species group	Diameter class (inches)			All diameters	
	10-12	14-18	20+		
	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.	Percent
Softwoods:					
Yellow pine[1/]	126,800	234,900	111,200	472,900	63.2
Virginia pine	20,400	13,200	200	33,800	4.5
Other	200	3,900	2,100	6,200	0.8
All softwoods	147,400	252,000	113,500	512,900	68.5
Hardwoods:					
Oaks	-	56,200	21,800	78,000	10.4
Gums[2/]	-	77,200	40,300	117,500	15.7
Other	-	22,000	18,200	40,200	5.4
All hardwoods	-	155,400	80,300	235,700	31.5
All species	147,400	407,400	193,800	748,600	100.0

1/Loblolly and shortleaf pine.
2/Black and water tupelo, sweetgum, and yellowpoplar.

Table 40. - Net increment in cords by species group and tree-diameter class, 1940

Species group	Diameter class (inches)				All diameters	
	6-8	10-12	14-18	20+		
	Cords	Cords	Cords	Cords	Cords	Percent
Softwoods:						
Yellow pine[1/]	246,400	419,900	671,400	259,900	1,597,600	51.4
Virginia pine	79,500	73,200	40,800	400	193,900	6.2
Other	-3,500	1,500	9,000	4,400	11,400	0.4
All softwoods	322,400	494,600	721,200	264,700	1,802,900	58.0
Hardwoods:						
Oaks	138,800	160,300	167,400	54,000	520,500	16.7
Gums[2/]	174,500	90,500	191,200	96,400	552,600	17.8
Other	88,900	38,400	60,100	44,700	232,100	7.5
All hardwoods	402,200	289,200	418,700	195,100	1,305,200	42.0
All species	724,600	783,800	1,139,900	459,800	3,108,100	100.0

1/Loblolly and shortleaf pine.
2/Black and water tupelo, sweetgum, and yellowpoplar.

Table 41. - Net increment in cubic feet by species group and tree-diameter class, 1940

Species group	Diameter class (inches)				All diameters	
	6-8	10-12	14-18	20+		
	M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.	Percent
Softwoods:						
Yellow pine[1/]	15,890	28,610	47,920	19,330	111,750	53.6
Virginia pine	5,150	4,940	2,870	30	12,990	6.2
Other	-250	100	710	360	920	0.4
All softwoods	20,790	33,650	51,500	19,720	125,660	60.2
Hardwoods:						
Oaks	8,140	9,810	10,800	3,750	32,500	15.6
Gums[2/]	10,400	5,750	12,640	6,520	35,310	16.9
Other	5,570	2,470	4,000	3,110	15,150	7.3
All hardwoods	24,110	18,030	27,440	13,380	82,960	39.8
All species	44,900	51,680	78,940	33,100	208,620	100.0

1/Loblolly and shortleaf pine.
2/Black and water tupelo, sweetgum, and yellowpoplar.

Table 42. - Drain by commodity and species group, 1940

IN BOARD FEET (INT. ¼-INCH RULE)

Commodity	Yellow pine	Virginia pine	Other softwoods	Oaks	Gums & yellow-poplar	Other hardwoods	All species	
	M bd.ft.	M bd.ft.	M bd.ft.	M bd.ft.	M bd.ft.	M bd.ft.	M bd.ft.	Percent
Lumber	311,900	18,200	10,300	24,200	34,200	2,000	400,800	66.2
Veneer	700	-	100	-	15,400	300	16,500	2.7
Nail kegs	19,900	-	-	-	300	-	20,200	3.3
Potato barrels	1,100	-	-	-	-	-	1,100	0.2
Excelsior	6,600	300	-	-	-	-	6,900	1.1
Pulpwood	62,200	13,200	-	-	900	-	76,300	12.6
Misc.mfg.products[1/]	1,200	-	900	300	100	300	2,800	0.5
Fuel wood	34,900	6,100	-	9,300	2,200	900	53,400	8.8
Hewn crossties	200	-	-	12,100	-	-	12,300	2.0
Poles and piles	12,500	-	-	300	500	200	13,500	2.2
Fence posts	100	-	900	900	100	100	2,100	0.4
All products	451,300	37,800	12,200	47,100	53,700	3,800	605,900	100.0

IN CORDS

	Cords	Cords	Cords	Cords	Cords	Cords	Cords	Cords
Lumber	803,500	63,800	24,800	69,600	89,100	5,400	1,056,200	50.2
Veneer	1,800	-	200	-	39,400	700	42,100	2.0
Nail kegs	75,000	-	-	-	1,500	-	76,500	3.6
Potato barrels	4,500	-	-	-	-	-	4,500	0.2
Excelsior	36,700	2,200	-	-	-	-	38,900	1.8
Pulpwood	269,300	72,500	-	-	7,300	-	349,100	16.6
Misc.mfg.products[1/]	3,400	-	5,200	700	500	1,100	10,900	0.5
Fuel wood	160,700	38,100	-	160,500	38,900	22,500	420,700	20.0
Hewn crossties	900	-	100	48,200	100	-	49,300	2.4
Poles and piles	35,300	300	-	800	1,400	600	38,400	1.8
Fence posts	600	200	5,700	6,400	200	5,600	18,700	0.9
All products	1,391,700	177,100	36,000	286,200	178,400	35,900	2,105,300	100.0

1/Includes miscellaneous cooperage, handles, wood turning, shingles, boxes, shuttle blocks.

Table 43. - Drain by commodity and tree-diameter class, 1940

IN BOARD FEET (INT. $\frac{1}{4}$-INCH RULE)

Commodity	Diameter-class (inches)				All diameters
	6-8	10-12	14-18	20+	
	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.
Lumber	-	50,300	173,900	176,600	400,800
Veneer	-	-	5,900	10,600	16,500
Nail kegs	-	12,200	8,000	-	20,200
Potato barrels	-	800	300	-	1,100
Excelsior	-	5,500	1,400	-	6,900
Pulpwood	-	55,500	20,800	-	76,300
Misc. mfg. products[1/]	-	1,000	1,500	300	2,800
Fuelwood	-	31,400	18,400	3,600	53,400
Hewn crossties	-	200	12,100	-	12,300
Poles and piles	-	2,000	11,500	-	13,500
Fence posts	-	900	1,100	100	2,100
All products	-	159,800	254,900	191,200	605,900
	Percent	Percent	Percent	Percent	Percent
	-	26.4	42.1	31.5	100.0

IN CORDS

	Cords	Cords	Cords	Cords	Cords
Lumber	10,700	185,700	460,700	399,100	1,056,200
Veneer	-	900	15,800	25,400	42,100
Nail kegs	11,100	44,200	21,200	-	76,500
Potato barrels	800	2,800	900	-	4,500
Excelsior	15,700	19,400	3,800	-	38,900
Pulpwood	87,300	206,000	55,800	-	349,100
Misc. mfg. products[1/]	2,900	3,500	3,600	900	10,900
Fuelwood	124,700	235,500	52,000	8,500	420,700
Hewn crossties	200	13,000	36,100	-	49,300
Poles and piles	500	7,200	30,700	-	38,400
Fence posts	7,600	7,900	2,900	300	18,700
All products	261,500	726,100	683,500	434,200	2,105,300
	Percent	Percent	Percent	Percent	Percent
	12.4	34.5	32.5	20.6	100.0

1/Includes miscellaneous cooperage, handles, wood turning, shingles, boxes, shuttle blocks.

Table 44. - Commodity drain in board feet (Int. $\frac{1}{4}$-inch rule) by species group and tree-diameter class, 1940

Species group	Diameter class (inches)			All diameters	
	10-12	14-18	20 +		
	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.	Percent
Softwoods:					
Yellow pine[1/]	131,200	185,700	134,400	451,300	74.5
Virginia pine	25,700	12,100	-	37,800	6.2
Other	2,900	4,000	5,300	12,200	2.0
All softwoods	159,800	201,800	139,700	501,300	82.7
Hardwoods:					
Oaks	-	30,900	16,200	47,100	7.8
Gums[2/]	-	20,000	33,700	53,700	8.9
Other	-	2,200	1,600	3,800	0.6
All hardwoods	-	53,100	51,500	104,600	17.3
All species	159,800	254,900	191,200	605,900	100.0

1/Loblolly and shortleaf pine.
2/Black and water tupelo, sweetgum, and yellowpoplar.

Table 45. - Commodity drain in cords by species group and tree-diameter class, 1940

Species group	Diameter class (inches)				All diameters	
	6-8	10-12	14-18	20 +		
	Cords	Cords	Cords	Cords	Cords	Percent
Softwoods:						
Yellow pine[1/]	143,000	461,900	487,800	299,000	1,391,700	66.1
Virginia pine	41,300	100,300	35,500	-	177,100	8.4
Other	6,900	8,300	9,700	11,100	36,000	1.7
All softwoods	191,200	570,500	533,000	310,100	1,604,800	76.2
Hardwoods:						
Oaks	44,300	111,100	91,100	39,700	286,200	13.6
Gums[2/]	14,800	29,800	53,500	80,300	178,400	8.5
Other	11,200	14,700	5,900	4,100	35,900	1.7
All hardwoods	70,300	155,600	150,500	124,100	500,500	23.8
All species	261,500	726,100	683,500	434,200	2,105,300	100.0

1/Loblolly and shortleaf pines.
2/Black and water tupelo, sweetgum, and yellowpoplar.

Table 46. - Commodity drain in cubic feet by species group and tree-diameter class, 1940

Species group	Diameter class (inches)				All diameters	
	6-8	10-12	14-18	20+		
	M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.	Percent
Softwoods:						
Yellow pine[1/]	9,290	31,480	34,850	22,230	97,850	67.6
Virginia pine	2,690	6,790	2,500	-	11,980	8.3
Other	500	610	770	890	2,770	1.9
All softwoods	12,480	38,880	38,120	23,120	112,600	77.8
Hardwoods:						
Oaks	2,600	6,790	5,880	2,760	18,030	12.5
Gums[2/]	880	1,900	3,530	5,430	11,740	8.1
Other	700	950	390	280	2,320	1.6
All hardwoods	4,180	9,640	9,800	8,470	32,090	22.2
All species	16,660	48,520	47,920	31,590	144,690	100.0

1/Loblolly and shortleaf pine.
2/Black and water tupelo, sweetgum, and yellowpoplar.

Table 47. - Net change in growing stock by species group and tree-diameter class, 1940

IN BOARD FEET (INT. ¼-INCH RULE)

Species group	Diameter class (inches)				All diameters
	6-8	10-12	14-18	20+	
	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.
Softwoods:					
Yellow pine[1]	-	-4,400	49,200	-23,200	21,600
Virginia pine	-	-5,300	1,100	200	-4,000
Other	-	-2,700	-100	-3,200	-6,000
All softwoods	-	-12,400	50,200	-26,200	11,600
Hardwoods:					
Oaks	-	-	25,300	5,600	30,900
Gums[2]	-	-	57,200	6,600	63,800
Other	-	-	19,800	16,600	36,400
All hardwoods	-	-	102,300	28,800	131,100
All species	-	-12,400	152,500	2,600	142,700

IN CORDS

	Cords	Cords	Cords	Cords	Cords
Softwoods:					
Yellow pine[1]	103,400	-42,000	183,600	-39,100	205,900
Virginia pine	38,200	-27,100	5,300	400	16,800
Other	-10,400	-6,800	-700	-6,700	-24,600
All softwoods	131,200	-75,900	188,200	-45,400	198,100
Hardwoods:					
Oaks	94,500	49,200	76,300	14,300	234,300
Gums[2]	159,700	60,700	137,700	16,100	374,200
Other	77,700	23,700	54,200	40,600	196,200
All hardwoods	331,900	133,600	268,200	71,000	804,700
All species	463,100	57,700	456,400	25,600	1,002,800

1/Loblolly and shortleaf pine.
2/Black and water tupelo, sweetgum, and yellowpoplar.

Table 48. - Comparison between increment and drain of saw-timber material, 1940

BY SPECIES GROUP

Item	Growing stock Jan. 1, 1940	Increment	Mortality	Net increment	Commodity drain	Net change	Growing stock Jan. 1, 1941
	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.
Softwoods:							
Yellow pine[1/]	7,289,400	493,400	20,500	472,900	451,300	21,600	7,311,000
Virginia pine	352,500	35,000	1,200	33,800	37,800	-4,000	348,500
Other	277,300	8,600	2,400	6,200	12,200	-6,000	271,300
All softwoods	7,919,200	537,000	24,100	512,900	501,300	11,600	7,930,800
Hardwoods:							
Oaks	1,012,600	81,500	3,500	78,000	47,100	30,900	1,043,500
Gums[2/]	1,955,800	123,900	6,400	117,500	53,700	63,800	2,019,600
Other	860,400	43,100	2,900	40,200	3,800	36,400	896,800
All hardwoods	3,828,800	248,500	12,800	235,700	104,600	131,100	3,959,900
All species	11,748,000	785,500	36,900	748,600	605,900	142,700	11,890,700

BY TREE-DIAMETER CLASS

Softwoods:							
10-12	3,300,600	158,900	11,500	147,400	159,800	-12,400	3,288,200
14-18	3,536,200	262,200	10,200	252,000	201,800	50,200	3,586,400
20 and over	1,082,400	115,900	2,400	113,500	139,700	-26,200	1,056,200
All softwoods	7,919,200	537,000	24,100	512,900	501,300	11,600	7,930,800
Hardwoods:							
14-18	2,300,300	160,900	5,500	155,400	53,100	102,300	2,402,600
20 and over	1,528,500	87,600	7,300	80,300	51,500	28,800	1,557,300
All hardwoods	3,828,800	248,500	12,800	235,700	104,600	131,100	3,959,900
All diameters	11,748,000	785,500	36,900	748,600	605,900	142,700	11,890,700

1/Loblolly and shortleaf pine.
2/Black and water tupelo, sweetgum, and yellowpoplar.

Table 49. - Comparison in cords between increment and drain of all sound material 5.0 inches d.b.h. and larger, 1940

BY SPECIES GROUP

Item	Growing stock Jan. 1, 1940	Increment	Mortality	Net increment	Commodity drain	Net change	Growing stock Jan. 1, 1941
	Cords	Cords	Cords	Cords	Cords	Cords	Cords
Softwoods:							
Yellow pine[1/]	29,846,000	1,726,700	129,100	1,597,600	1,391,700	205,900	30,051,900
Virginia pine	2,339,700	207,000	13,100	193,900	177,100	16,800	2,356,500
Other	823,400	20,700	9,300	11,400	36,000	-24,600	798,800
All softwoods	33,009,100	1,954,400	151,500	1,802,900	1,604,800	198,100	33,207,200
Hardwoods:							
Oaks	9,152,600	546,500	26,000	520,500	286,200	234,300	9,386,900
Gums[2/]	12,012,500	586,400	33,800	552,600	178,400	374,200	12,386,700
Other	5,847,900	249,700	17,600	232,100	35,900	196,200	6,044,100
All hardwoods	27,013,000	1,382,600	77,400	1,305,200	500,500	804,700	27,817,700
All species	60,022,100	3,337,000	228,900	3,108,100	2,105,300	1,002,800	61,024,900

BY TREE-DIAMETER CLASS

Softwoods:							
6-8	9,369,000	400,100	77,700	322,400	191,200	131,200	9,500,200
10-12	11,798,100	536,200	41,600	494,600	570,500	-75,900	11,722,200
14-18	9,395,700	747,900	26,700	721,200	533,000	188,200	9,583,900
20 and over	2,446,300	270,200	5,500	264,700	310,100	-45,400	2,400,900
All softwoods	33,009,100	1,954,400	151,500	1,802,900	1,604,800	198,100	33,207,200
Hardwoods:							
6-8	7,475,800	423,900	21,700	402,200	70,300	331,900	7,807,700
10-12	9,372,000	310,200	21,000	289,200	155,600	133,600	9,505,600
14-18	6,462,500	435,200	16,500	418,700	150,500	268,200	6,730,700
20 and over	3,702,700	213,300	18,200	195,100	124,100	71,000	3,773,700
All hardwoods	27,013,000	1,382,600	77,400	1,305,200	500,500	804,700	27,817,700
All diameters	60,022,100	3,337,000	228,900	3,108,100	2,105,300	1,002,800	61,024,900

1/Loblolly and shortleaf pine.
2/Black and water tupelo, sweetgum, and yellowpoplar.

Table 50. - Comparison in cubic feet between increment and drain of all sound material 5.0 inches d.b.h. and larger, 1940

BY SPECIES GROUP

Item	Growing stock Jan. 1, 1940	Increment	Mortality	Net increment	Commodity drain	Net change	Growing stock Jan. 1, 1941
	M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.
Softwoods:							
Yellow pine[1/]	2,047,430	120,430	8,680	111,750	97,850	13,900	2,061,330
Virginia pine	156,290	13,850	860	12,990	11,980	1,010	157,300
Other	62,980	1,610	690	920	2,770	-1,850	61,130
All softwoods	2,266,700	135,890	10,230	125,660	112,600	13,060	2,279,760
Hardwoods:							
Oaks	567,600	34,130	1,630	32,500	18,030	14,470	582,070
Gums[2/]	766,800	37,480	2,170	35,310	11,740	23,570	790,370
Other	381,580	16,260	1,110	15,150	2,320	12,830	394,410
All hardwoods	1,715,960	87,870	4,910	82,960	32,090	50,870	1,766,850
All species	3,982,680	223,760	15,140	208,620	144,690	63,930	4,046,610

BY TREE-DIAMETER CLASS

Softwoods:							
6-8	609,480	25,860	5,070	20,790	12,480	8,310	617,790
10-12	803,820	36,500	2,850	33,650	38,880	-5,230	798,590
14-18	671,040	53,400	1,900	51,500	38,120	13,380	684,420
20 and over	182,360	20,130	410	19,720	23,120	-3,400	178,960
All softwoods	2,266,700	135,890	10,230	125,660	112,600	13,060	2,279,760
Hardwoods:							
6-8	448,050	25,410	1,300	24,110	4,180	19,930	467,980
10-12	588,560	19,340	1,310	18,030	9,640	8,390	596,950
14-18	425,540	28,540	1,100	27,440	9,800	17,640	443,180
20 and over	253,830	14,580	1,200	13,380	8,470	4,910	258,740
All hardwoods	1,715,980	87,870	4,910	82,960	32,090	50,870	1,766,850
All diameters	3,982,680	223,760	15,140	208,620	144,690	63,930	4,046,610

1/Loblolly and shortleaf pine.
2/Black and water tupelo, sweetgum, and yellowpoplar.

DEFINITION OF TERMS

General

Forest Survey Unit. -- The term "forest survey unit" denotes an area of 4 to 10 million acres in which topographic, forest, and economic conditions are reasonably homogeneous.

Land-use Classes

Commercial forest. -- Forest land having qualities essential to the production of commercial timber.

Public reserved forest. -- Forest land in federal and state ownership upon which commercial timber cutting is prohibited.

Agriculture. -- Non-forest land used for production of farm crops within the last five years.

Abandoned cropland. -- Land once cultivated, now evidently abandoned for farm crops, but not bearing forest cover.

Pasture. -- Cleared, fenced lands that are used primarily for grazing.

Marsh. -- Non-forested areas in low, boggy areas bordering lakes and streams, where drainage is too poor to permit agricultural use.

Other non-forest. -- Includes areas within the corporate limits and suburban or industrial sections of towns and cities; power, rail, and highway rights-of-way; sand dunes, water areas, and miscellaneous non-forest.

Forest Types

Loblolly pine. -- Stands in which softwood make up 25 percent or more of the dominant and codominant trees with loblolly pine predominating.

Shortleaf pine. -- Stands in which softwoods make up 25 percent or more of the dominant and codominant trees with shortleaf pine predominating.

Virginia pine. -- Stands in which softwoods make up 25 percent or more of the dominant and codominant trees with Virginia pine predominating.

Bottomland hardwoods. -- Stands of mixed hardwoods in swamps and along streams in which hardwood species make up 75 percent or more of the dominant and codominant trees.

Upland hardwoods. -- Stands on well drained, upland sites in which mixed oaks and other hardwoods constitute 75 percent or more of the dominant and codominant trees.

Diameters

D.b.h. (diameter at breast height). -- Diameter in inches, outside bark, measured at $4\frac{1}{2}$ feet from the ground.

Diameter class. -- All trees were tallied by 2-inch diameter classes each class including diameters 1.0 inch below and 0.9 inch above the stated midpoint.

Forest Condition

Saw-timber stands. -- Stands containing sufficient volume in merchantable species to make at least 600 board feet per acre in the pine types and 1,000 board feet per acre in the hardwood types.

Cordwood stands. -- Stands of second growth in which the total saw-timber volume is less than the required minimum for sawlog stands.

Reproduction. -- Stands of young second growth with little or no volume in trees over 1" in diameter, but bearing at least 80 well distributed seedlings per acre.

Clear-cut. -- Cut-over areas bearing insufficient young growth to qualify as reproduction.

Tree Classification

Sound saw-timber tree. -- A softwood tree at least 9.0 inches d.b.h., and a hardwood tree at least 13.0 inches d.b.h. with not less than one sound butt log 12 feet long, or with 50 percent of the gross volume of the tree in sound saw timber.

Sound cordwood tree. -- Any sound, straight-boled tree between 1.0 inch d.b.h. and sawlog size.

Cull tree. -- Any tree that fails to qualify as a sound tree because of poor form, excessive limbiness, rot, or other defect.

Pole tree. -- A pine tree that will produce a pole conforming to specifications of the American Standards Association.

Volume Estimates

Board-foot volume. -- The volume in board feet, exclusive of defect, of that portion of sound sawlog-size trees between the stump and the upper limit of merchantability for sawlogs, measured by the International $\frac{1}{4}$-inch rule.

Cordwood volume. -- The volume in standard cords of the sound portion of trees 5.0 inches d.b.h. and larger between stump and a minimum diameter of approximately 4.0 inches outside bark.

Cubic-foot volume. -- The solid cubic volume, excluding bark, of all material included in the cordwood estimate.

Increment

Growing stock. -- The sum of the volumes of all sound trees 5.0 inches d.b.h. and larger; dead and cull trees and tops of hardwood not included.

Board-foot increment. -- Includes the net growth on the saw-timber portion of sawlog-size trees, plus the volume in sound trees reaching sawlog size.

Cordwood increment. -- Includes the net growth on the sound stemwood of pines and cedar 5.0 inches d.b.h. and over, on understawlog-size hardwoods, and on the sawlog portion of sawlog-size hardwoods, plus the sound-tree volume of all species reaching 5.0 inches d.b.h. during the increment period.

Cubic-foot increment. -- Omits bark volumes, otherwise material is identical with cordwood.

Mortality

Mortality. -- The volume lost from the growing stock of the forest through the death of individual trees. Natural causes of mortality include lightning, tree competition, old age, disease, insects, drought, and wind. Fire is the major man-caused source of mortality.

Utilization

Production. -- The volume of wood manufactured or consumed within the designated area, and expressed in units of measure characteristic of the industry.

Commodity drain. -- The volume of wood cut in the designated area from sound living trees, adjusted for such cutting practices as may over-cut or under-cut the basic volume tables, and excluding the cordwood volume cut from tops of hardwoods.